1 SEPTEMBER 1960

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ELECTRICAL TIMES

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SPEEDY
SAFE

An actual phase to-earth fault is applied momentarily and the Tester checks that the prospective fault current of three times the fuse rating can flow.

Model No. 1 for testing single-phase or three-phase four-wire earthed neutral supplies up to 60 amperes. Selected fuse ratings 15, 30, 40 and 60 amperes. Suitable for P.M.E. systems (Protective Multiple Earthing).

Model No. 2 has additional facilities for testing up to 150 amperes, single-phase and three-phase, three or four-wire. Selected fuse ratings 15, 30, 40, 60, 75, 100 and 150 amperes. Suitable for P.M.E. systems (Protective Multiple Earthing).

Please write for List IN.13

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Phase-Earth Loop Impedance Tester

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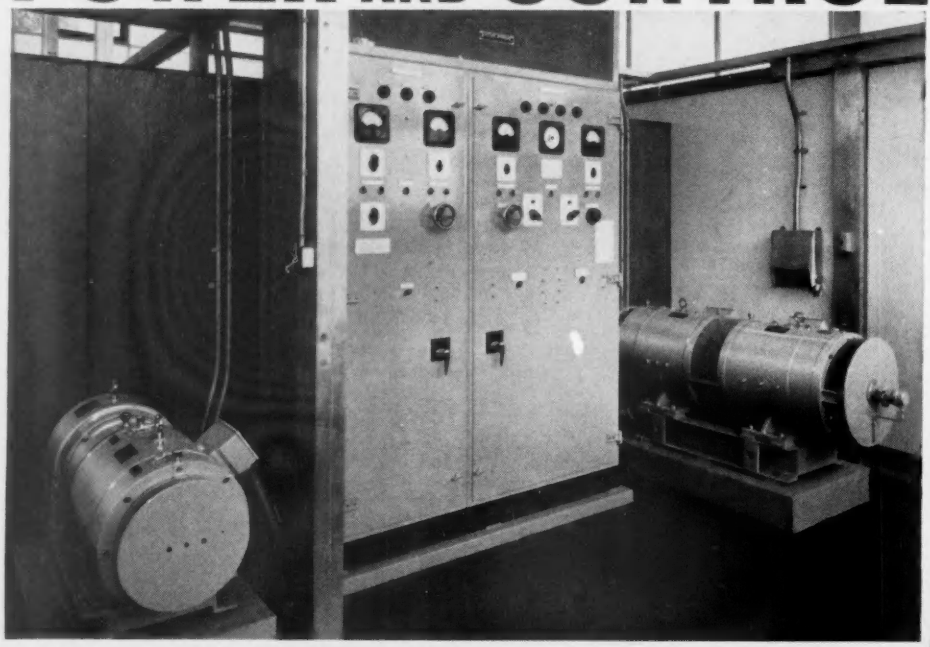
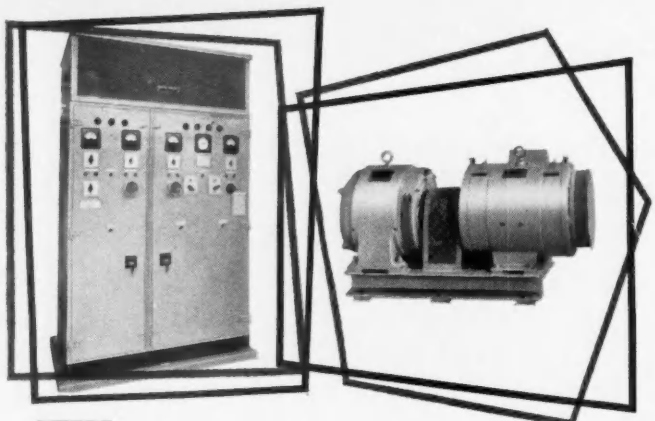
POWER AND CONTROL



Electrical equipment destined for Canada is tested in the British Standards Institution on behalf of the Canadian Standards Association using E.D.C.C. equipment. This is a further example of custom-built special purpose equipment by E.D.C.C.

The E.D.C.C. installation comprises an A.C./D.C. motor generator set to provide D.C. power, maximum rating 7.5 kW at D.C. voltages between 90 and 250 volts; and a D.C./A.C. motor-alternator set, with a maximum rated output at 7.5 kW, which provides a variable frequency between 25 and 60 cycles. Mains input to each set is 400/440 volts, 3-phase, 50 cycles. A Combined Control Panel is also supplied.



E.D.C.C. are manufacturers of:

Dynamometers	HF alternators
Rotary convertors	Voltage stabilisers
Flame-proof marine motors	Rotary transformers
Frequency changers	Battery traction motors
Induction regulators	D.C. generators
Single and Polyphase alternators	Magnetic couplings
	Control gear, etc.

ELECTRO·DYNAMIC

CONSTRUCTION COMPANY LIMITED

ST. MARY CRAY ORPINGTON KENT TELEPHONE: ORPINGTON 27551 TELEGRAMS: ELEDAMIC ST. MARY CRAY

Control Gear Division: Bridgwater Somerset Telephone: Bridgwater 2882 Glasgow Office: 40 Houldsworth St C3 Telephone: Central 2620

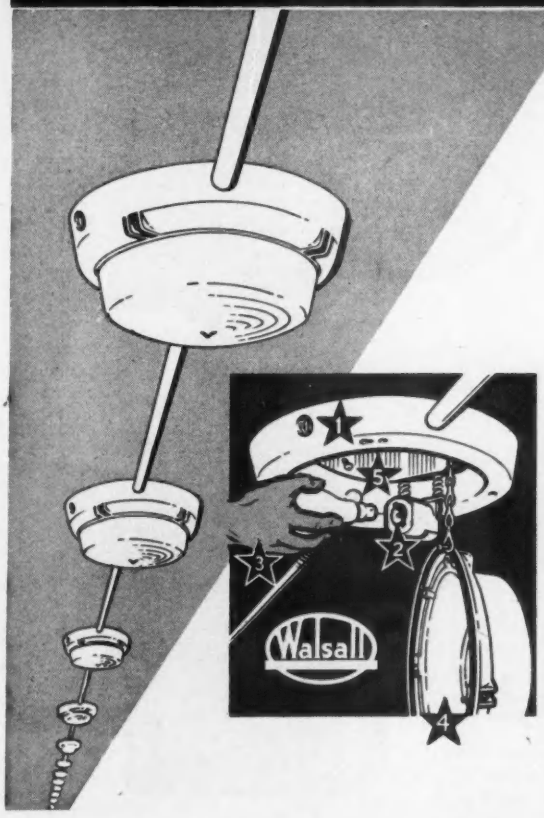
P.5255

a new creation in industrial space Lighting

Walsall Orbit

CIRCULAR LIGHTING FITTING

100 WATT



A circular lighting fitting for surface mounting on canopy or wall with attractive internally-frosted glass and smooth interior.

STANDARD FINISH
Matt black base with hammer grey glass retaining ring
CAST IRON—List No. 7430—53/- each.
CAST ALUMINIUM—List No. 7435—63/- each.

ALTERNATIVE FINISHES
Matt black base with glass retaining ring finished either hammer blue, gold, or green.
Finished overall hammer grey, blue, gold or green.
PRICES ON APPLICATION.

STAR FEATURES . . . . .

1. Smooth cast base with four ¾" outlets at N. S. E. and W. three with stopping plugs. Fixing holes brick centres.
2. Easy wiring anti-vibration porcelain lampholder (Patent No. 837214).
3. ONE HANDED twist on glass assembly with captive screws and safety chain to facilitate re-lamping
4. Weatherproof joints to render unit suitable for exterior use.
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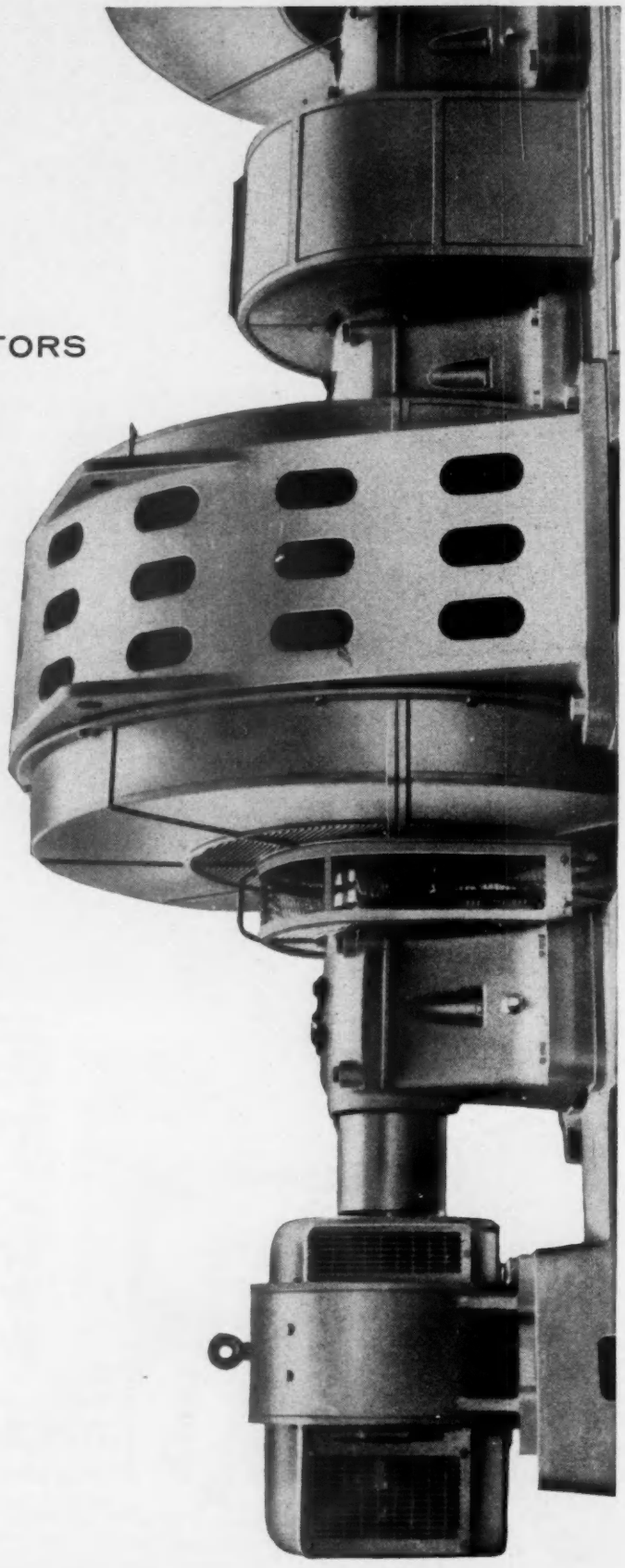
EXCELSIOR WORKS, WEST BROMWICH, STAFFS.

Branches in all leading provincial cities and towns.

A

DESIGNING

AND MAKING A.C. MOTORS



You, as an engineer, know that there can be no sharp dividing line between designing and building. A good design incorporates experience gained in making, testing and installing similar equipment in the past. And, of course, it is also shaped by the experience of all sorts of people using the earlier designs under a variety of conditions that could not be simulated in any test laboratory.

To a long-established company such as Crompton Parkinson this process of feedback of information to the designer is fundamental. It is the guiding factor in those details that defy specification but which, in aggregate, have so profound an effect on reliability and performance.

Crompton Parkinson have a long history as manufacturers of induction motors. The largest of these—in the 300 h.p. to 5000 h.p. range—are built at the Chelmsford factory where the first Crompton motors were made more than 75 years ago.

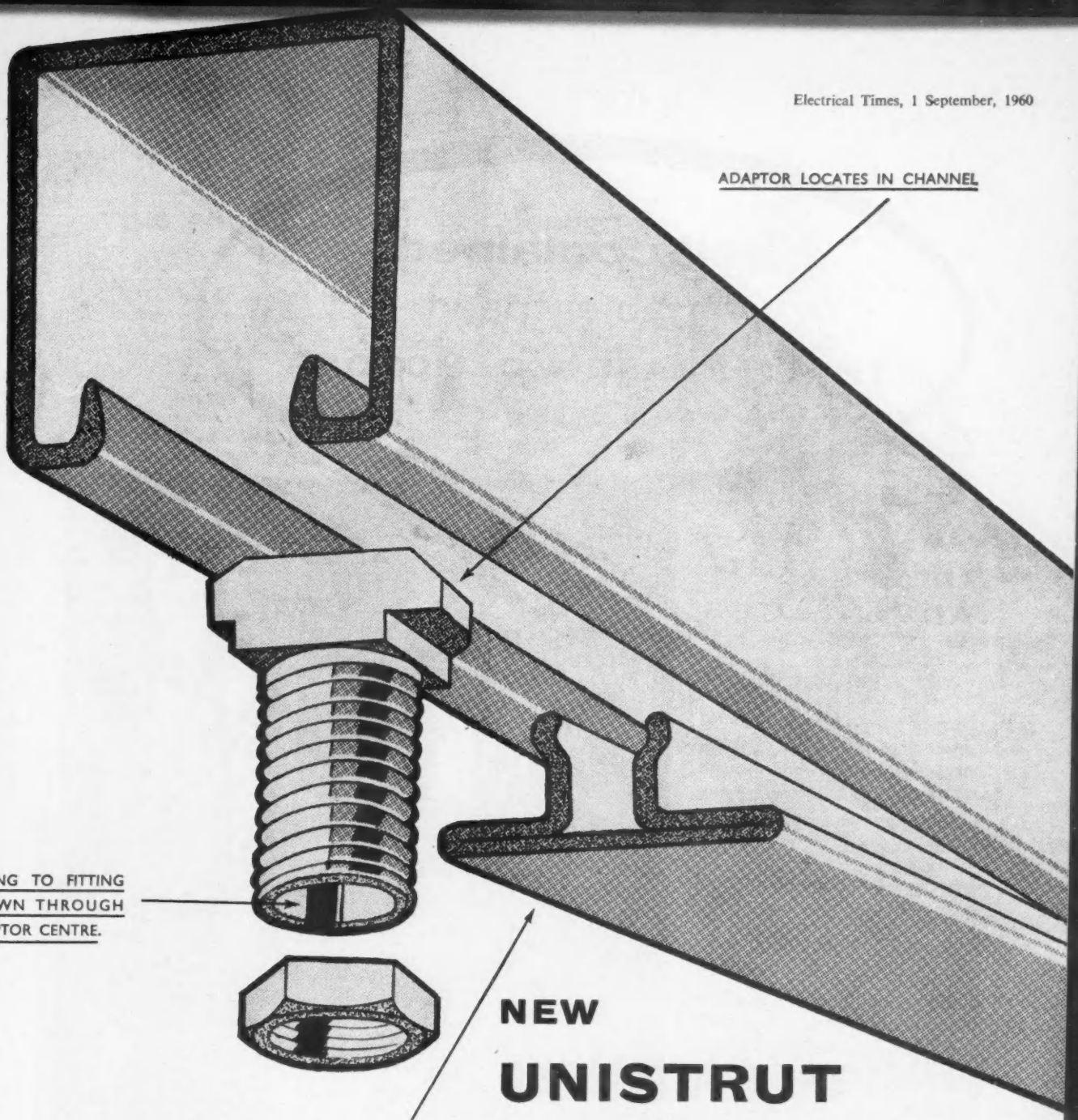
Also from Chelmsford come the Autosynchronous motors—a type of machine originally developed and patented by Crompton Parkinson—which combine the starting simplicity and robust construction of the induction motor with the ability to run at unity or leading power-factor. They are particularly valuable for correcting the power-factor of loads consisting predominantly of induction motors.

Crompton Parkinson LIMITED

ELECTRICAL EQUIPMENT

Makers of Electric Motors of all kinds, A.C. and D.C. Generators, Cables, Switchgear, B.E.T. Transformers, Instruments, Lamps, Lighting Equipment, Batteries, Stud Welding Equipment, Traction Equipment, Ceiling Fans

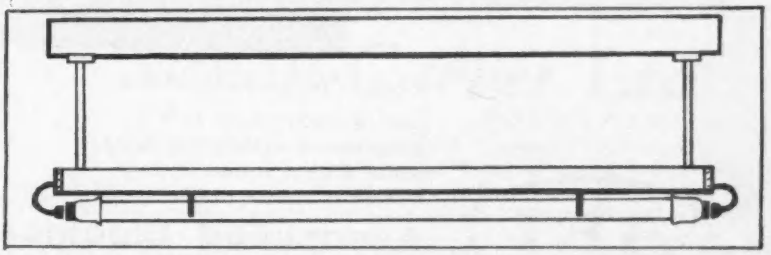
CROMPTON HOUSE, ALDWYCH, LONDON, W.C.2


ADAPTOR LOCATES IN CHANNEL
WIRING TO FITTING DRAWN THROUGH ADAPTOR CENTRE.
WIRING IN CHANNEL CONCEALED BY PUSH-IN COVER STRIP.

NEW
UNISTRUT
FLUORESCENT
LIGHTING ADAPTOR

NEATER—MORE ECONOMICAL.

With this new component, attachment of fluorescent fittings to Unistrut channel (still the cheapest and neatest trunking) is made even simpler. The fittings may be attached either direct as shown above, or on droppers of ¾" conduit attached by a standard socket to the male thread of the adaptor. In either case, wiring is drawn from the channel through the centre hole of the adaptor which is of brass for good earthing. The end of the adaptor which fits inside the channel is shaped like the normal Unistrut nut, to combine positive location with easy adjustment of position.



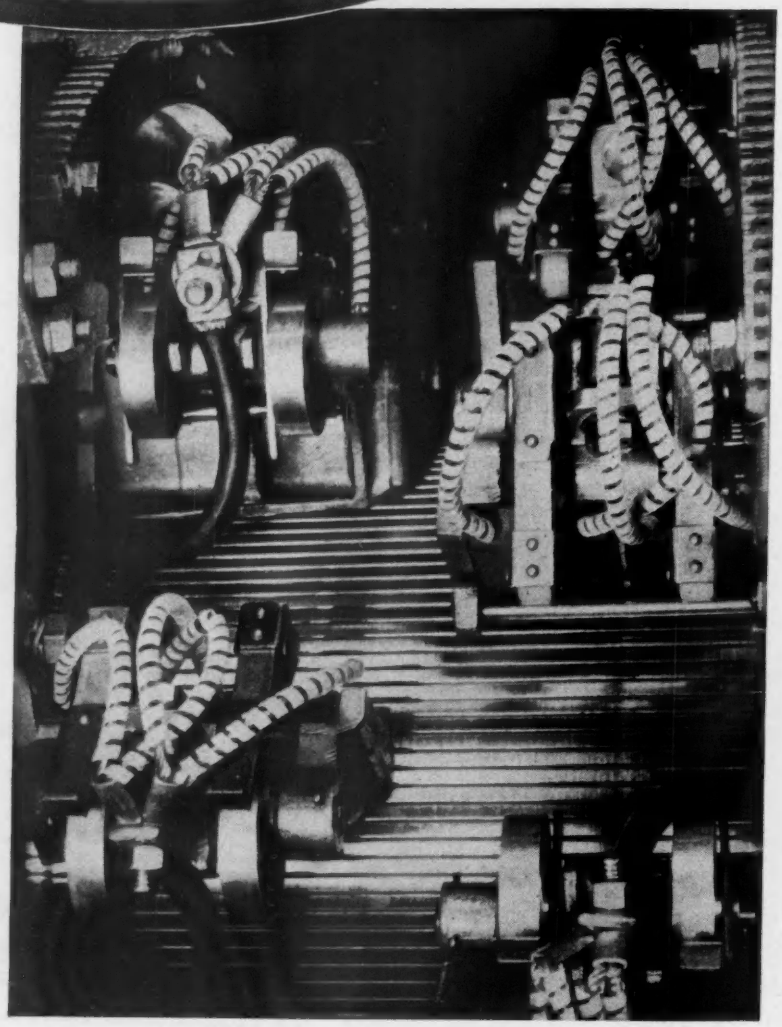
For drawing and details of the new component to bring your Parts Catalogue up to date, or general information on the Unistrut system in fluorescent trunking and all electrical applications, please write to:

UNISTRUT DIVISION OF SANKEY-SHELDON LTD.

43/45 Broadwater Road, Welwyn Garden City, Herts. Telephone: Welwyn Garden City 6321 (4 lines)

UNI/619

Self-contained
variable-speed
THREE-PHASE A.C. MOTORS



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Speed

Stepless variation, with unlimited speed ratios. No external regulator. Wide speed range, with reverse operation when required. Speed variation may be by hand, remote or servo control.

High Performance

Good shunt characteristics at all speeds, whether motoring or generating. High efficiency and power factor throughout top half of speed range. High starting torque with low starting current.

Good Delivery

Motors up to 100 h.p. are built from stock parts ensuring short delivery times. Many sizes from 3 h.p. upwards available from stock.

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Small Industrial Machines Sales,
Motor & Control Gear Division.
BLACKHEATH, STAFFS.

(FOR MOTORS ABOVE 30 H.P.)
Medium Electrical Machine Sales,
Heavy Plant Division,
RUGBY.

AEI

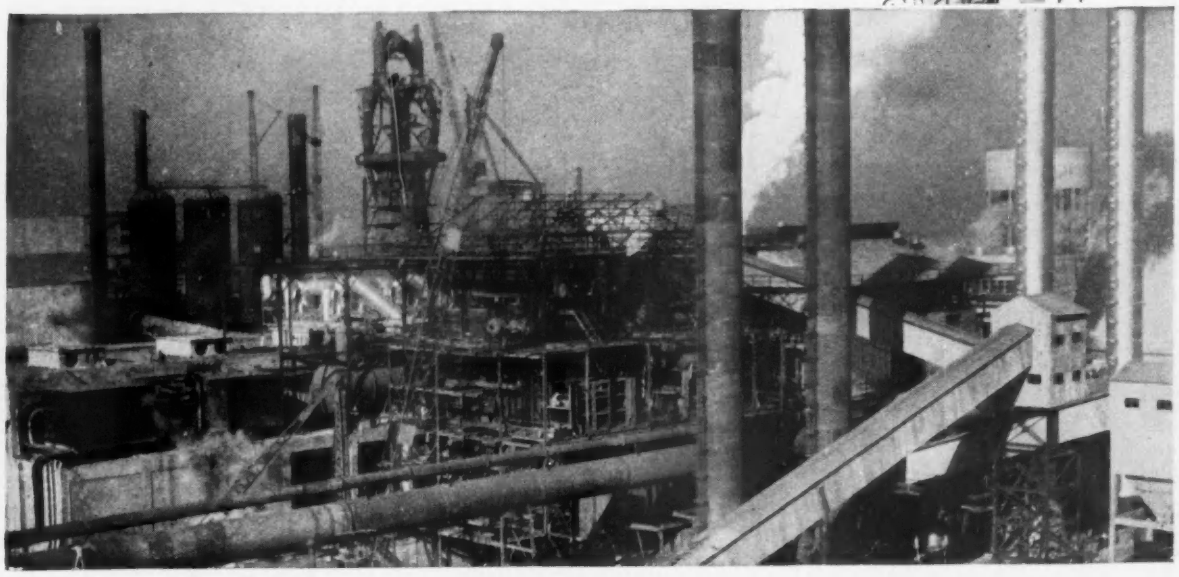
Associated Electrical Industries Limited

A5571

THE POWER BEHIND THE GODDESS

The Steel Goddess was the description given recently to the new Durgapur steelworks. This was apt not only because of its immense importance to Indian steel, but also because Durgapur means 'the place of Durga' and Durga is the ten-armed Goddess of Bengal.

The power behind the annual production of one million ingot tons of steel is one of our many responsibilities at Durgapur. The Goddess's heart, the power plant, consists of four Simon-Carves water-tube boilers producing steam for vital steelworks services; the associated fuel and ash handling plants, cooling system and steam distribution network are all Simon-Carves designed and built.



COMPLETE POWER PLANT BY *Simon-Carves Ltd*

STOCKPORT, ENGLAND

and at CALCUTTA · JOHANNESBURG · SYDNEY · TORONTO

At Durgapur we are also building the coke ovens and coke handling plant, the by-product plant, the coal washery, blending and handling plant and the inter-connecting services for gas, tar and steam.

SC 235
A*

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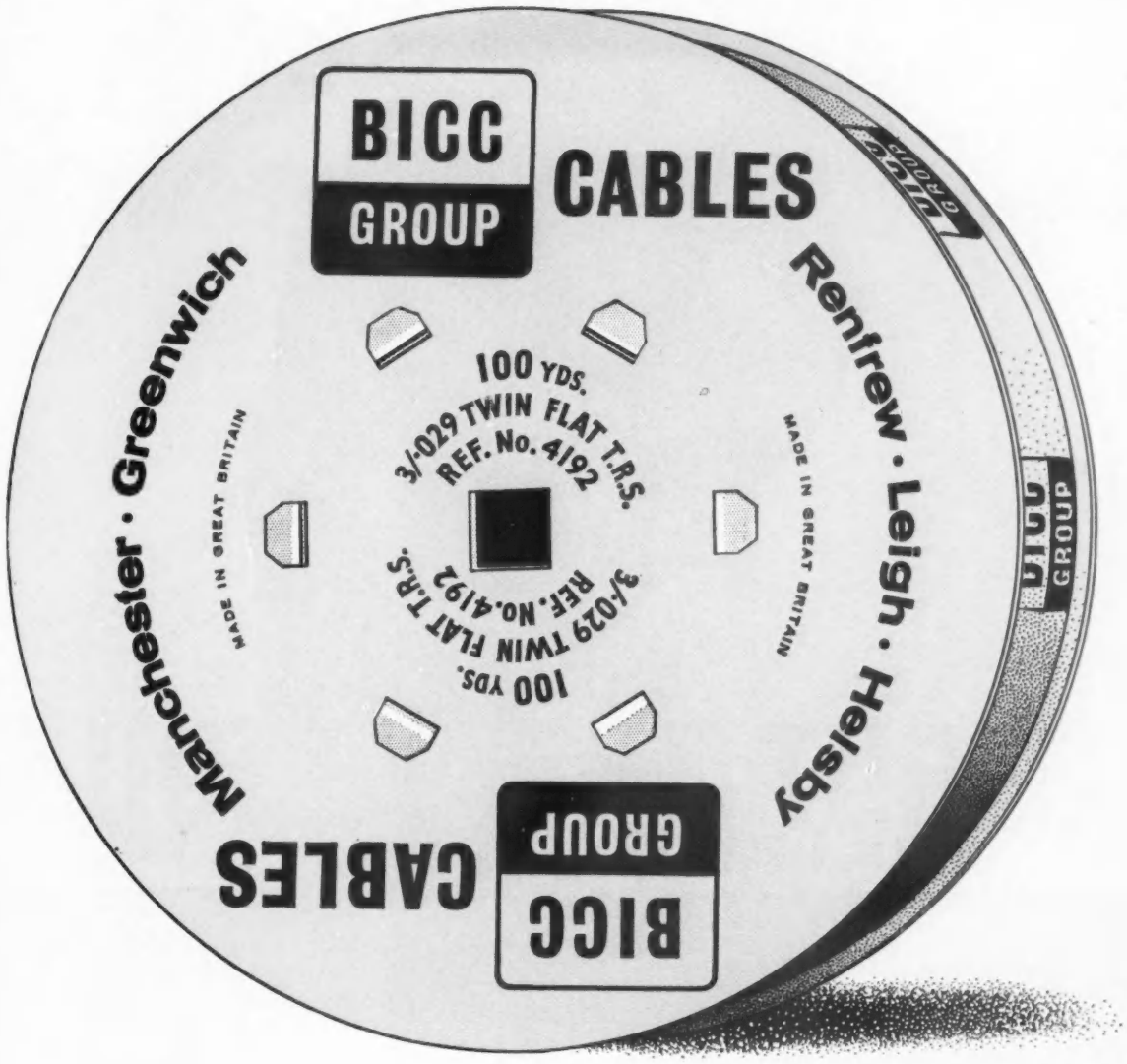

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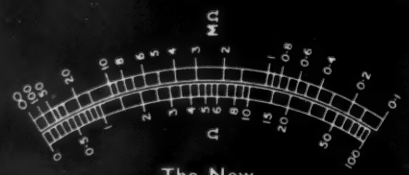

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DIMENSIONALLY INTERCHANGEABLE
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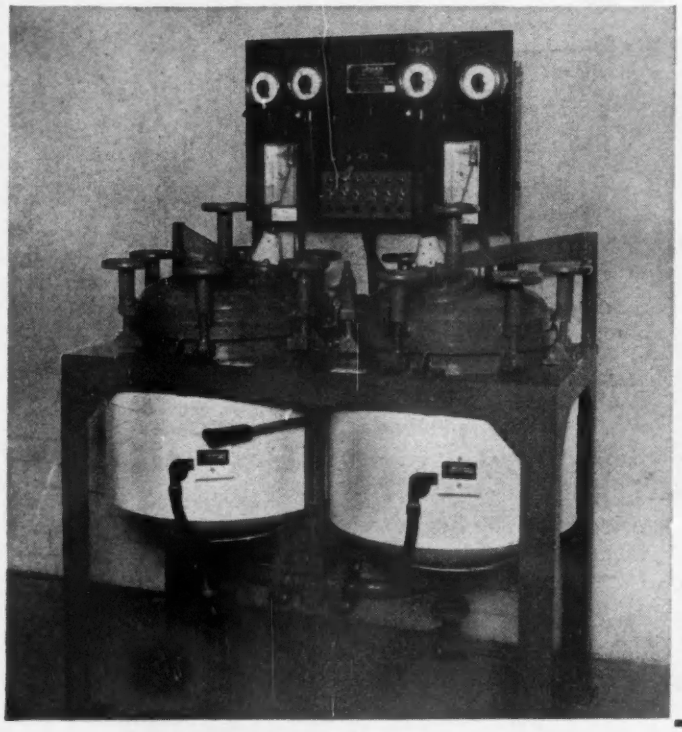

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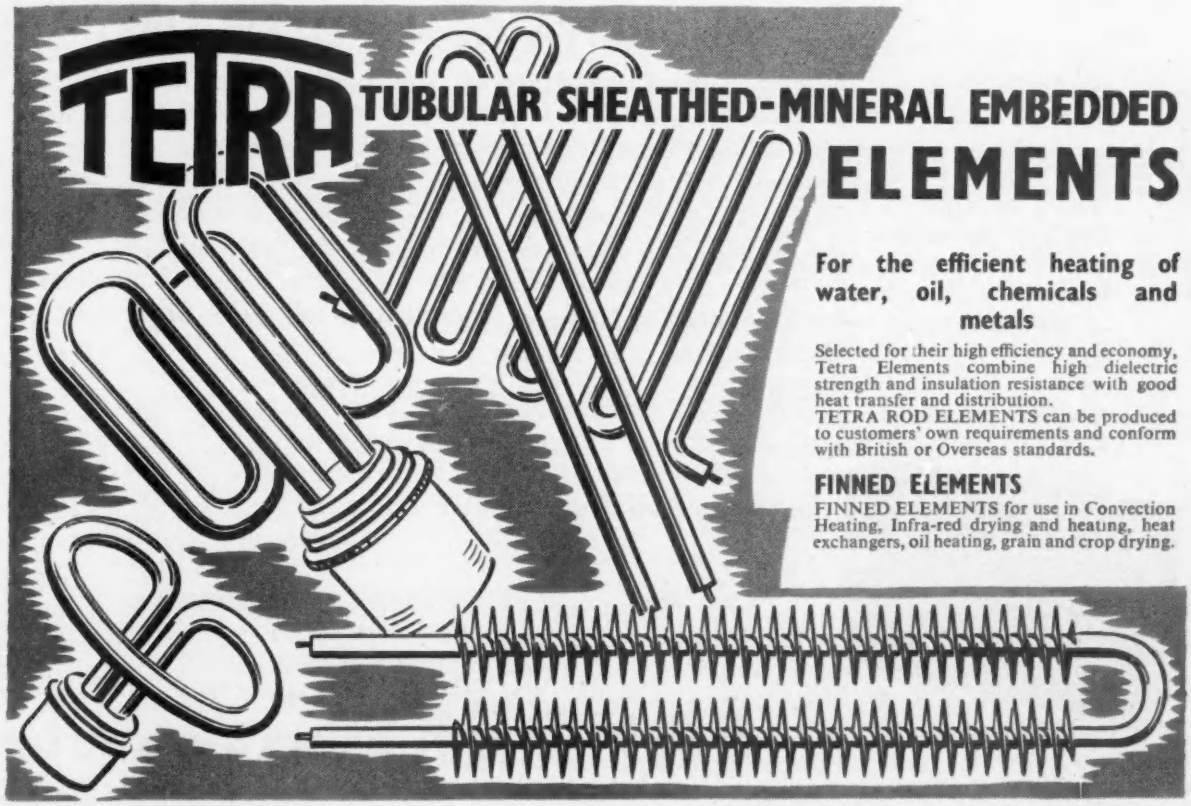

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PRICES & DETAILS, SEE LEAFLET 59/59

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NEWS SHEET

Supply industry manual earnings 87th in industry-by-industry list published by Ministry of Labour on basis of end-April inquiry. (327)

TUC says Government interference with nationalised industries must be open, but that some intervention must be expected. General Council against fixing nationalised industry wages by reference to private industry payments. Concern expressed about trades unionists on boards of nationalised industries. (299, 330)

Retailers holding back orders for more British refrigerators until stocks of imported models are cleared, alleges N. F. T. Saunders, managing director, Kelvinator Ltd. BEAMA may be submitting proposals for closer co-operation with Government on production, sales and stocks. (327)

Electrical exports in July were £20·3 m., over £200,000 up on June total, with domestic appliances showing biggest increase. Imports dropped slightly, with further big reduction for refrigerators. (323)

EMI take over of Morphy-Richards nearly through. Three directors, including F. P. Bishop (chairman) and C. F. Richards (joint managing director) think share exchange offer not decisively attractive. (328)

Increased work marks British Standards year 1959-60, says annual report which discusses troubles in some electrical standardisation projects. Revision of BS electrical installations code of practice aims to give guidance on adequate wiring of buildings. (299, 306)

Fluorescent tube prices drop as leading manufacturers introduce reductions up to 19%. All daylight, warm white, and a few de luxe and colour matching ranges affected from 1 September. (325)

Lamp bulbs from slot machines installed outside LEB Sydenham Showroom. Machine holds 84 lamps of various types. (329)

17- and 21-in. slim TV sets dominate Radio Show. Automatic contrast control, simpler tuning and improved maintenance access by many manufacturers. Several firms showing tape recorders for first time, and four-track versions in evidence. First all-transistor TV on show. (320)

PEOPLE—E. G. Plucknett (Simplex) joins TI board . . . J. F. Hollway becomes commercial manager and T. Atkins marketing manager, GEC Domestic Equipment group . . . with retirement of E. Nobbs, R. G. Smith is sole managing director, Watford Electric Mfg. and M. G. Jones promoted to sales director . . . E. F. P. Wheller leaves Hoover to join Kenwood as general home sales manager . . . H. R. Schofield appointed chief transmission project engineer, CEGB . . . L. J. Kettle of Dublin, dies. (316)

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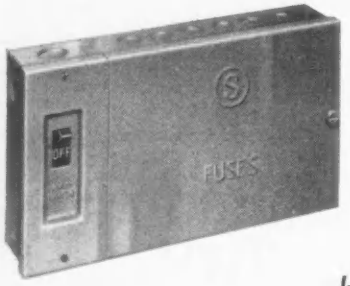

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Optional section for domestic goods at Electrical Engineers' Exhibition. Sited on first floor, but acceptors need not give up ground floor stands, lose place in ballot. (329)

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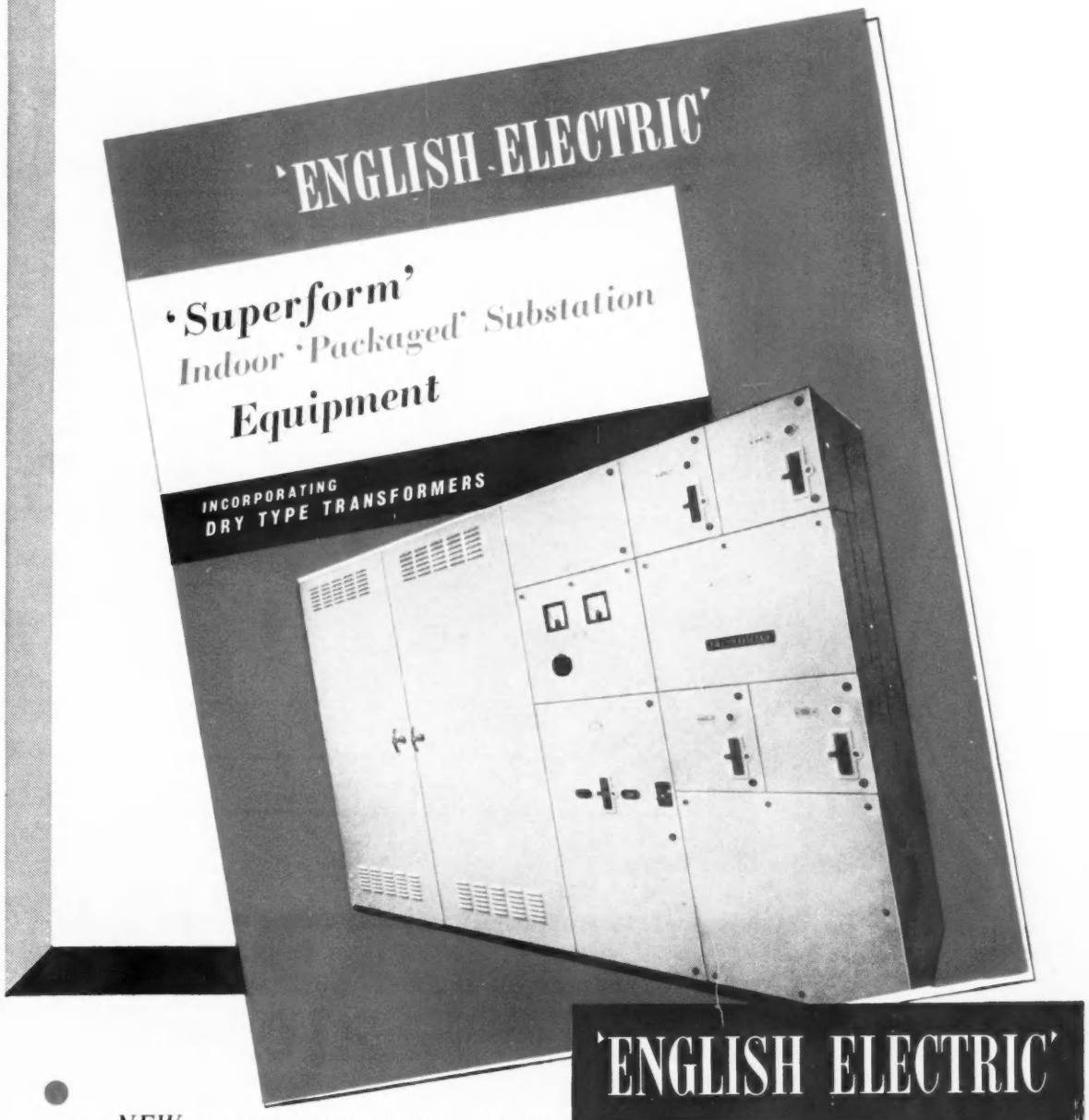
Pushbuttons should be half-in. diameter horizontally disposed if spacing cannot exceed 1½-in., show error-rate tests. (300, 307)

BUSINESS—Parkinson and Cowan acquire Bastian and Allen (327) . . . GEC reorganise distribution and publicity (328) . . . Record profit and dividend by George H. Scholes . . . Thorn's non-voting shares plan blocked . . . Optimistic prospects outlined by chairmen of Electrical Components (L. S. Seccombe), Efco (D. F. Campbell), Kango Hammers and Parmiter, Hope and Sugden (E. Sugden) (332) . . .

OVERSEAS—New Zealand £2 m. copper plant approved . . . Indian 300 MW nuclear site selected and proposals for supergrid; size of public works factory at Bhopal reduced . . . 6 m. h.p. hydro scheme on Manicouagan River started by Quebec Hydro; Ontario reports $213 m. revenue increase in year; wiring standards criticised by APEC (314) . . . 1958-59 NSW annual report shows surplus up despite reduction in unit charges resulting from coal-field generation, completion of first 330 kV line. (308)

what is a
'Packaged' Substation ?



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NEWS SHEET

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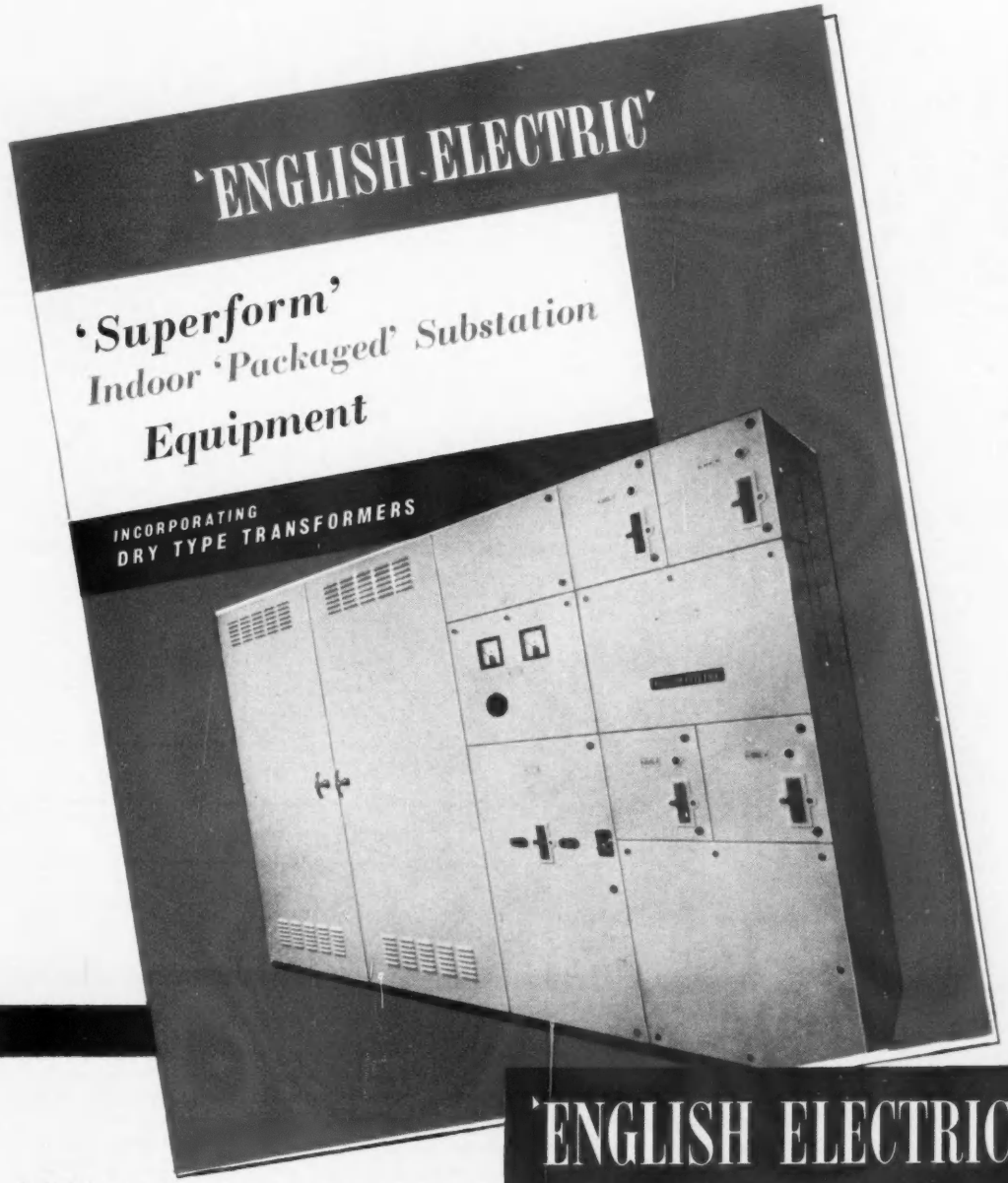
Cold-cathode triodes used for domestic switch test rig. Faulty switches classified according to type of fault found. (305)

Pushbuttons should be half-in. diameter horizontally disposed if spacing cannot exceed 1½-in., show error-rate tests. (300, 307)

BUSINESS—Parkinson and Cowan acquire Bastian and Allen (327) . . . GEC reorganise distribution and publicity (328) . . . Record profit and dividend by George H. Scholes . . . Thorn's non-voting shares plan blocked . . . Optimistic prospects outlined by chairmen of Electrical Components (L. S. Seccombe), Efco (D. F. Campbell), Kango Hammers and Parmiter, Hope and Sugden (E. Sugden) (332) . . .

OVERSEAS—New Zealand £2 m. copper plant approved . . . Indian 300 MW nuclear site selected and proposals for supergrid; size of public works factory at Bhopal reduced . . . 6 m. h.p. hydro scheme on Manicouagan River started by Quebec Hydro; Ontario reports $213 m. revenue increase in year; wiring standards criticised by APEC (314) . . . 1958-59 NSW annual report shows surplus up despite reduction in unit charges resulting from coal-field generation, completion of first 330 kV line. (308)

what is a 'Packaged' Substation ?



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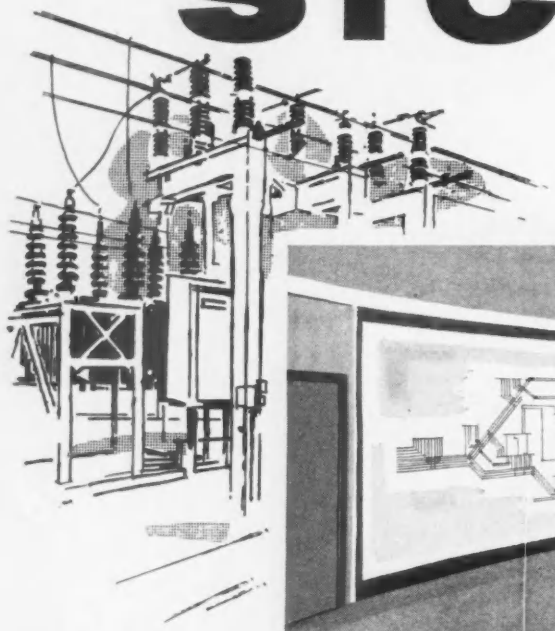
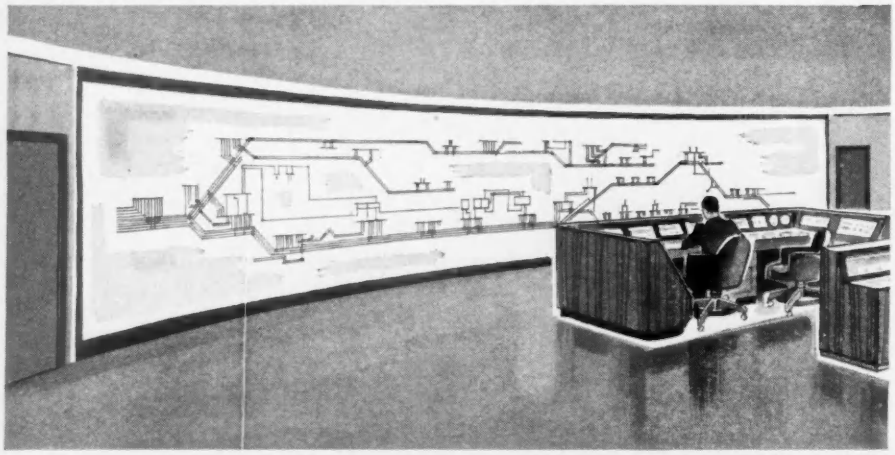
FG. 52
C

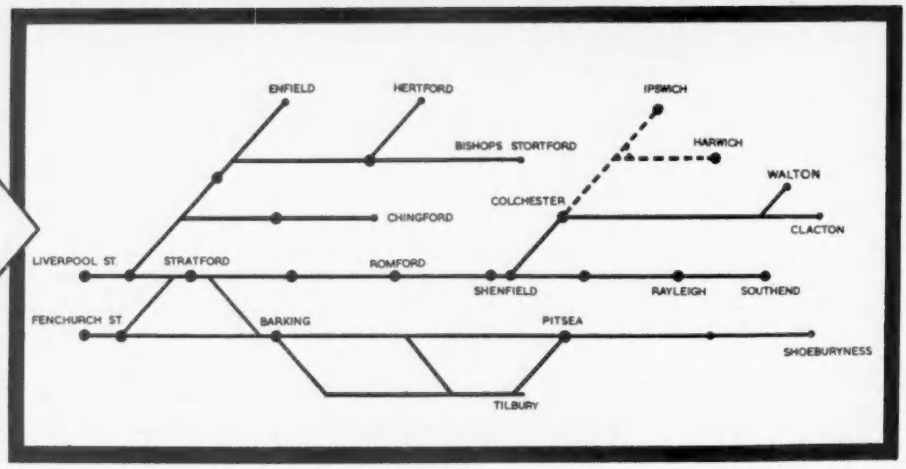
STC in control...



EASTERN REGION (BR) ELECTRIFICATION SCHEME



An artist's impression of the Romford Control Room.



The map shows the routes concerned, and the control stations at Romford and Pitsea serving the Liverpool Street and Fenchurch Street schemes respectively. When the schemes are completed, approximately 45 remote stations will be controlled from Romford and 14 from Pitsea.

STC, foremost among manufacturers of Supervisory Remote Control and Indication Systems, are now engaged in the installation of equipment to provide remote supervision of the feeder stations and track sectioning cabins on the routes out of Liverpool Street which are shortly to be electrified at 6·25kv and 25kv. Equipment is also in course of manufacture for the similar electrification scheme for the Fenchurch Street routes. The equipment employs the latest techniques in transistorised frequency-modulated signalling and incorporates special safeguards to prevent any incorrect operations. The control panels are of the 1" mosaic tile type, and control and indication devices have been specially devoloped to meet the B.T.C.'s requirements.

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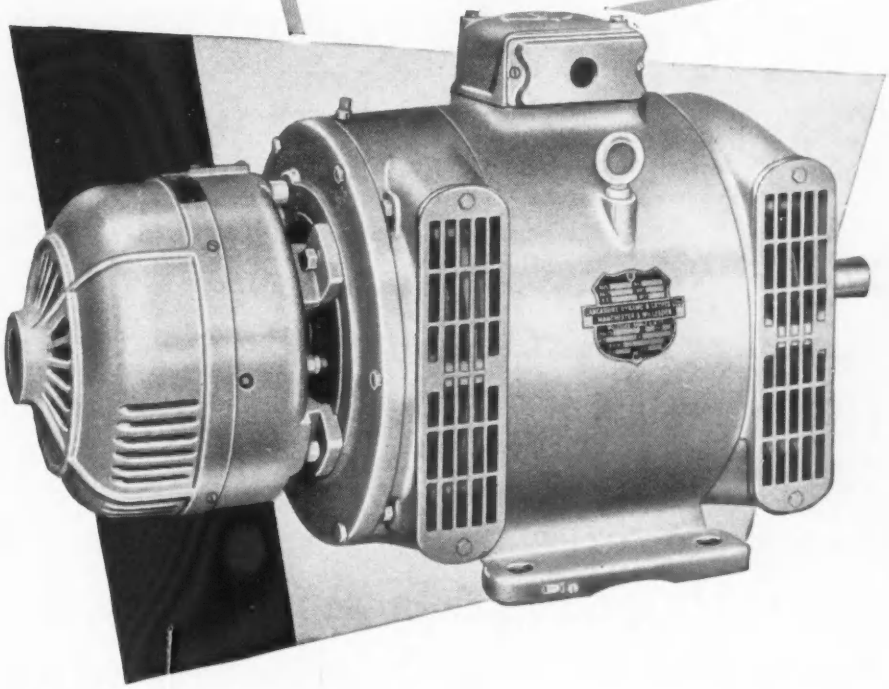

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Tube Rating	Standard Colours	From s.	From d.	To s.	To d.
8ft. 125 W	White Warm white Daylight	17	6	**16**	**0**
	Natural Deluxe warm white Colour matching	17	6	**18**	**0**
	Deluxe natural	24	0	**21**	**0**
5ft. 80 W	White Warm white Daylight	13	0	**10**	**6**
	Natural Deluxe warm white Colour matching	13	0	**12**	**6**
	Deluxe natural	17	6	**14**	**6**
4ft. 40 W	White Warm white Daylight	11	9	**9**	**9**
	Natural Deluxe warm white Colour matching	11	9	**11**	**0**
	Deluxe natural	15	0	**12**	**9**
3ft. 30 W	White Warm white Daylight	11	0	**9**	**9**
	Natural Deluxe warm white Colour matching	11	0	**11**	**0**
2ft. 40 W	White Warm white Daylight	11	0	**9**	**9**
	Natural Deluxe warm white Colour matching	11	0	**11**	**0**
2ft. 20 W	White Warm white Daylight	10	6	**9**	**3**
	Natural Deluxe warm white Colour matching	10	6	**10**	**6**
1½ft. 15 W	White Warm white Daylight	9	9	**8**	**9**
	Natural Deluxe warm white Colour matching	9	9	**9**	**9**

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3. Rigidity is imparted to the installation at the insulator through the certain contact of PREFORMED armour and the conductor, whilst the undue bulk of metal at the clamping point is avoided.

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5. In the event of failure of the conductor strands within the armoured part, the gripping forces available with PREFORMED armour maintain the original strength and conductivity of the span.

6. As PREFORMED Armour Rods are not deformed during application, they can be easily removed for purposes of re-sagging the conductor or for use elsewhere.

PREFORMED Armour Rods may be used on conductors of any size and will solve vibration problems by strengthening the conductor at points where damage may be expected to occur. They protect the conductor against flashover damage and they support it over a considerable length at insulator positions, giving a large radius of curvature and relief of stresses in the conductor caused by small clamping plates at suspension insulators and conductor binds at pin insulators. Good flexibility of the conductor is maintained at the clamps.

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AP 19

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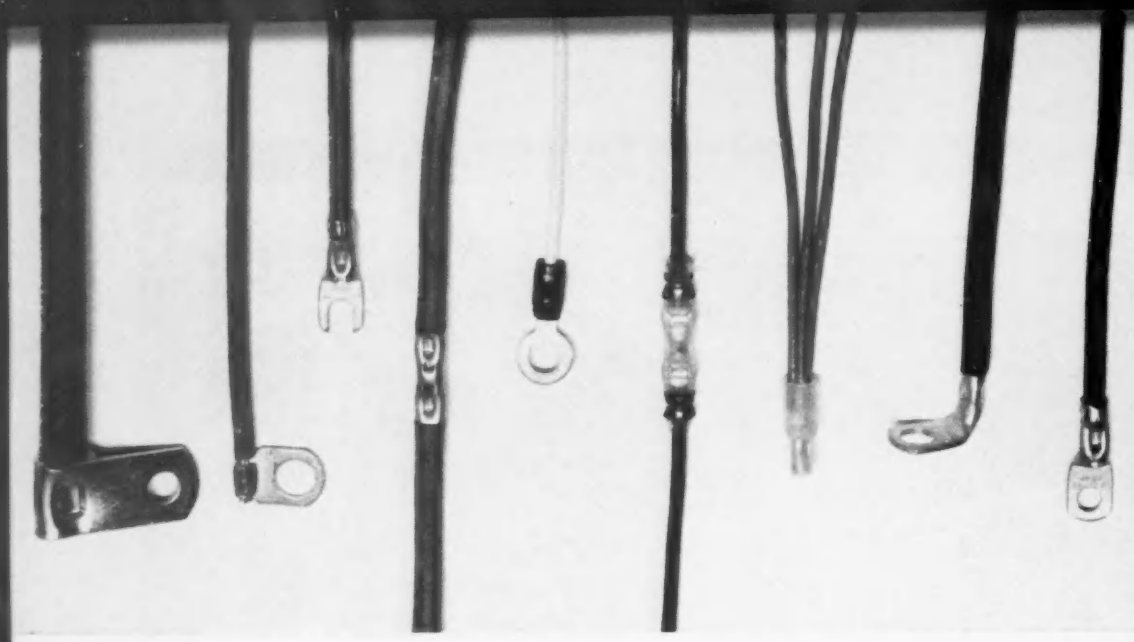

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2 ft 20w DOWN 1/6 to 10/10

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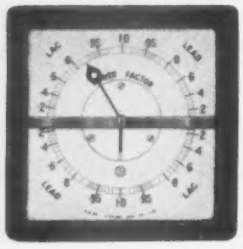

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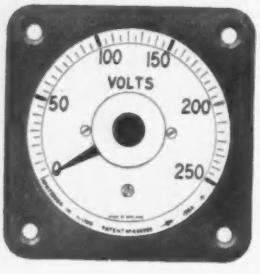

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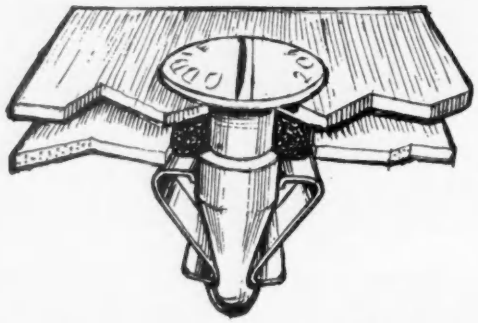

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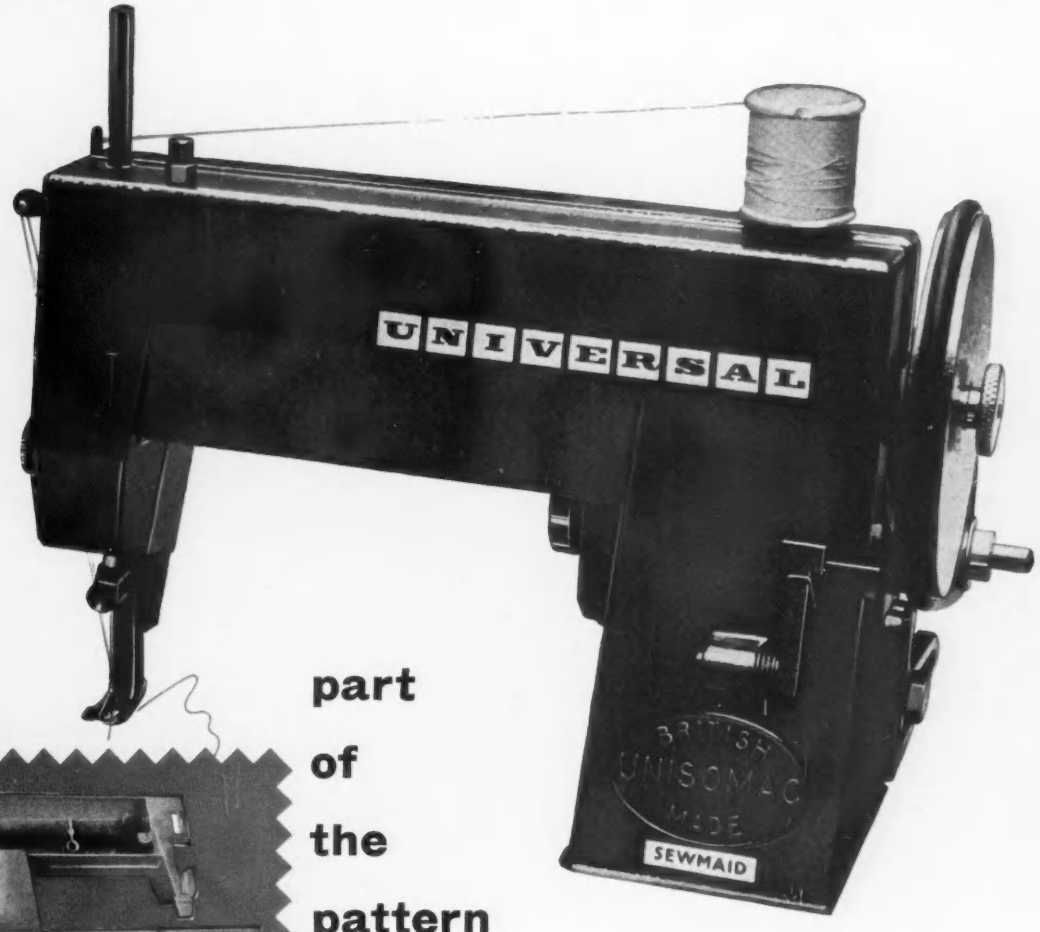

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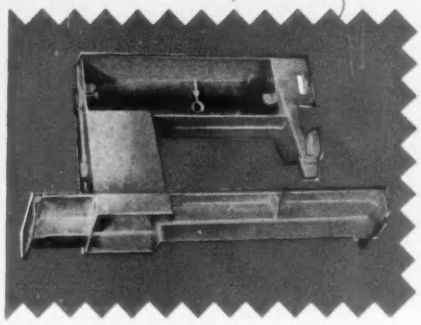

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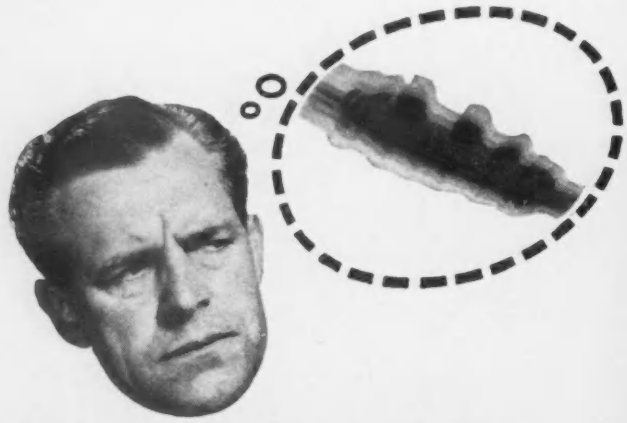

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	MAX.	MIN.		
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Netabulb P.V.C. Sticker MDM 290

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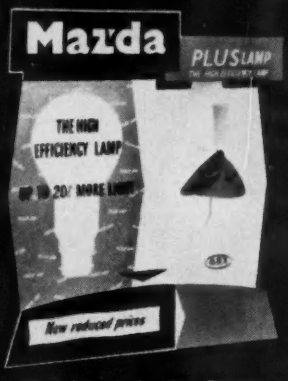
°Kolor-rite Fluorescent Lamp Leaflet AL 252

PLUS LAMPS

Plus Lamp P.V.C. Sticker

Plus Lamp Pelmet MDM 292



Plus Lamp Centre Piece MDM 293

Plus Lamp Showcard MDM 294

NETABULB Centre Piece* MDM 291; Pelmet MDM 289; Showcard MDM 276; P.V.C. Sticker MDM 290; 4-Lamp Pack MDM 286; Counter Dispenser; Booklet AL238.

DECORATION SETS Christmas Tree Centre Piece* MDM 288; Sell Out Showcard MDM 287; Mazda decorative booklet AL 248.

PLUS LAMP Wire dispenser MDM 267; centre piece* MDM 293; showcard MDM 294; pelmet* MDM 292; P.V.C. sticker; give-away leaflet AL 251.

KOLOR-RITE Fluorescent Lamp Leaflet AL 252.

(4881)

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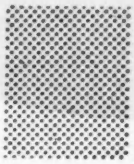

Class C & Class H *silicone-insulated, dry-type transformers are fire and explosion proof. They are not affected by dust and humidity. And because they will withstand repeated overloading, rating does not have to be based on peak loads. For safety, reliability and low maintenance costs, silicone-insulated transformers hold every advantage.*

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And so, in simple indisputable terms, it often costs less to have all the advantages of a Class C or a Class H installation.

Midland Silicones Ltd supply the silicone resins and elastomers used in the manufacture of Class C and Class H transformers. Here is a list of well-known British manufacturers producing silicone-insulated dry-type transformers for the United Kingdom and overseas.

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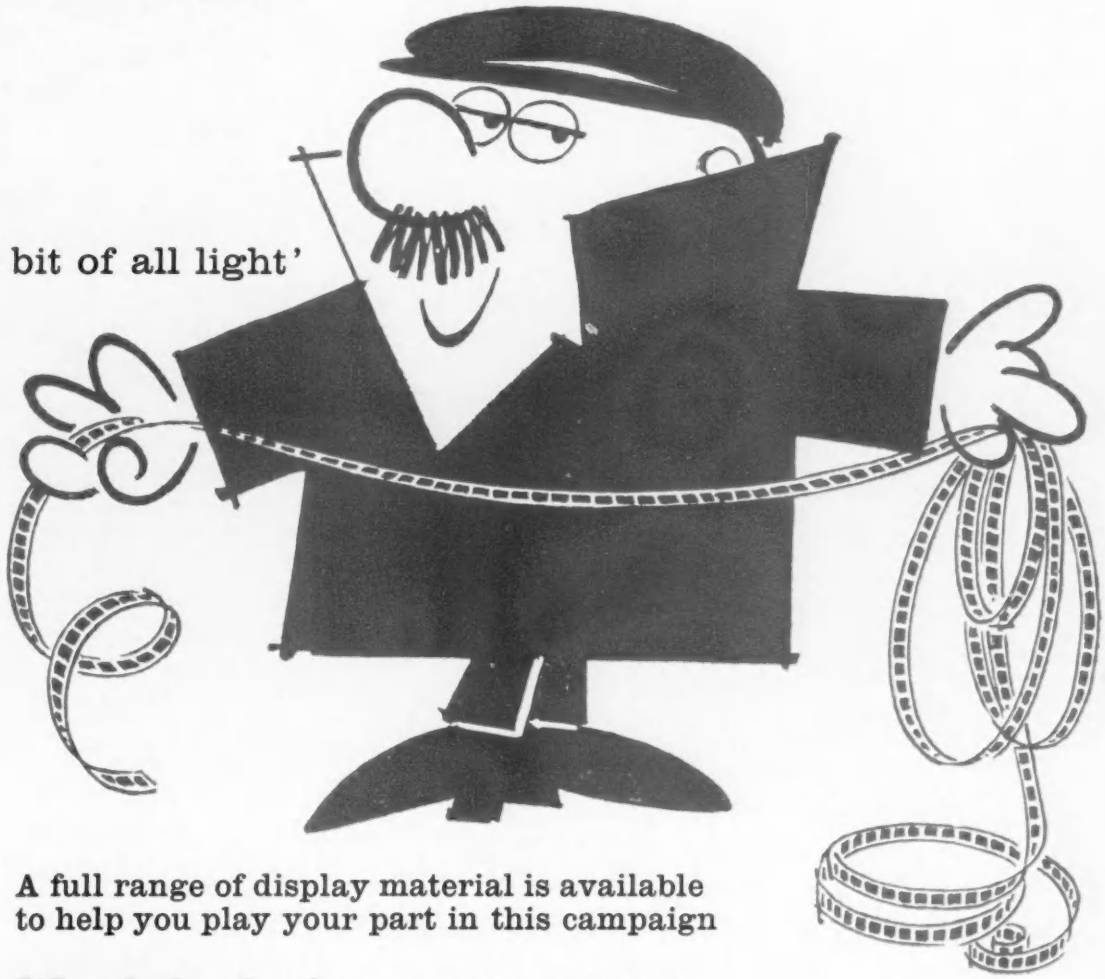

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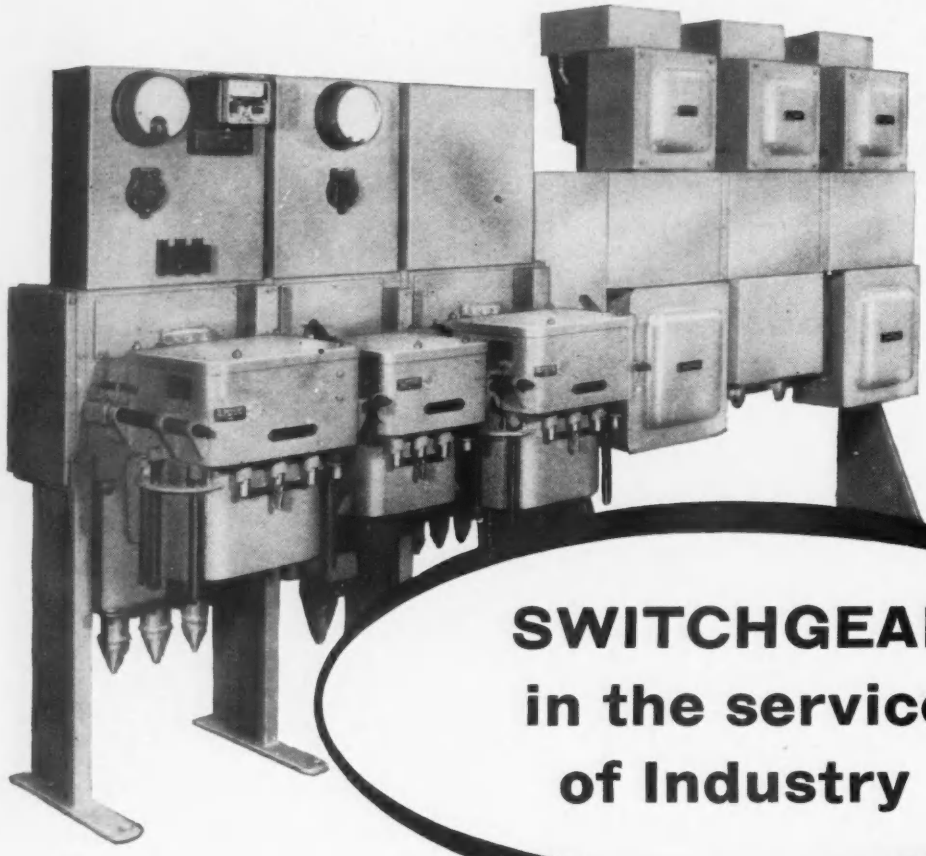

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THURSDAY 1 SEPTEMBER 1960

Registered as a Newspaper Volume 138 No. 9

Dans ce numéro

Génération MHD 301

Il sera peut-être possible d'améliorer les rendements thermiques dans la génération de l'électricité dépendant de la vapeur, si la génération " thermohydrodynamique " se révèle utilisable. Le principe de base consiste à introduire d'une façon ou d'une autre, des particules chargées électriquement dans les gaz chauffés soit en brûlant des combustibles fossiles, soit par les réacteurs nucléaires. Ces gaz passent dans une tuyère, ce qui transforme l'énergie thermique en énergie cinétique, dont une partie est extraite par couplage électrique ou magnétique et transmise á un circuit électrique. En conjonction avec un cycle de vapeur il peut être possible d'obtenir un rendement global atteignant 60%. Les applications envisagées intéressent essentiellement la génération à grande échelle, à des régimes de 100 MW et plus.

Régulateurs pour systèmes Electriques de Navires ... 309

Il faut utiliser des régulateurs de tension automatiques pour les machines d'un régime nominal de quelques centaines de kilowatts sur les navires possédant des organes auxiliaries à courant alternatif. Un élément essentiel d'un régulateur automatique de tension est le circuit de mesure de tension. On commence à utiliser des circuits électroniques, incluant des dispositifs à semi-conducteurs, ainsi qu'un certain nombre de types de circuits magnétiques.

Salon de la Radio 1960 320

Les récepteurs radio à transistors, fonctionnant sur pile ou sur secteur, occupent une place proéminente au salon des industries de la radio cette année. On constate aussi un accoissement du nombre et des modèles de magnétophones exposés. Certains modèles possèdent quatre pistes d'enregistrement. La majorité des récepteurs de télévision incluent maintenant de 43 à 54 cm tubes, et de nombreux modèles possèdent des dispositifs de sélection de programme commandés à distance ou part bouton-poussoir.

In dieser Nummer

MHD-Stromerzeugung 301

Die Wärmebilanz der dampfbetriebenen Stromerzeugung dürfte sich entschieden günstiger gestelten wenn sich einmal das " thermohydrodynamische " Stromerzeugungsverfahen als gangbar erwiesen hat. Das Grundprinzip dieses Verfahrens besteht darin, dass elektrisch geladene Teilchen auf irgend eine Weise in Gase eingeführt werden, die durch das Verbrennen fossiler Brennstoffe bzw. durch den Betrieb eines Nuklearreaktors erhitzt wurden. Die Gas durchströmen daraufhin eine Düse, wobei thermische in kinetische Energie verwandelt wird. Ein Teil dieser Energie wird mittels magnetischer oder elektrischer Kupplung entnommen und an einen elektrischen Kreis übertragen. Gesamtwirkungsgrade bis zu 60% dürften im Zusammenhang mit einem Dampfkreislauf erzielbar sein. Bezüglich der Anwendung wird vor allem an grössere Anlagen mit einer Nennleistung von mindestens 100 MW gedacht.

Selbsttätige Spannungsregler für Schiffsanlagen ... 309

Generatoren mit einer Nennleistung von einigen hunder Kilowatt, wie sie in Schiffe mit Wechselstrom-Hilfsmaschinen eingebaut werden, benötigen eine automatische Spannungsregelung. Einen wesentlichen Bestandteil eines automatischen Spannungsreglers bildet dessen Spannungsmesskreis. Hierfür kommen seit kurzer Zeit elektronische Kreise mit Halbleitervorrichtungen, sowie verschiedene Arten magnetischer Kreise, zur Anwendung.

Radioindustrie-Messe 1960 320

Auf der diesjährigen Radioindustrie-Messe nehmen unter den ausgestellten neuen Modellen transistorisierte Geräte sowohl für Netzanschluss wie für Batteriebetrieb einen hervorragenden Platz ein. Magnetband-Aufnahmegeräte sind ebenfalls in grösserer Anzahl und Vielfalt als bisher vertreten, manche davon vierspurig. Die ausgestellten Fernseh-Empfangsgeräte haben fast durchwegs 43 oder 54 cm- Bildröhren und viele davon auch fern- oder druckknopfgesteuerte Vorrichtungen zur Umschaltung von einem Kanal zum anderen.

ELECTRICAL TIMES

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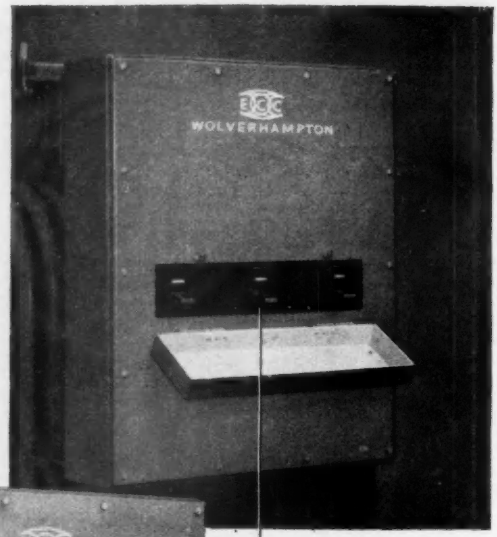
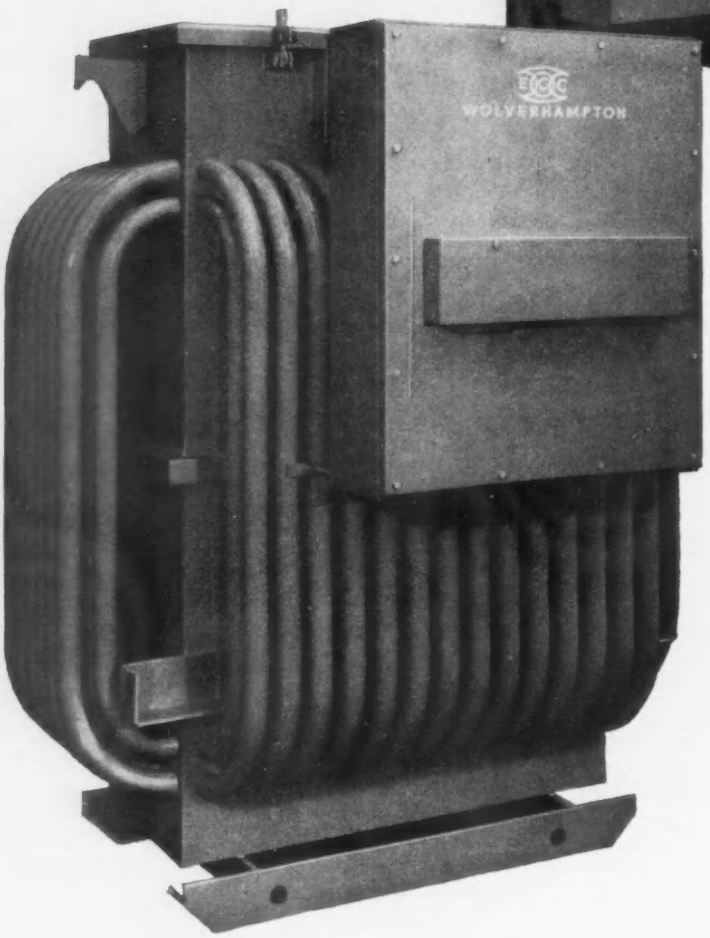
COMBINED TRANSFORMER AND LT SWITCHGEAR UNITS





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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 1 SEPTEMBER, 1960

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Comment

KEYSTONE CODE

BSI's annual report for 1959-60 breathes the spirit of an active organisation making significant progress with worth-while work. In no part of the report is this more apparent than in the electrical section, which has to deal with 106 standardisation projects in hand, ranging from 17 which are just starting to ten in which only the final stage of printing and publication remains before the file is closed. To this work on British Standards has to be added widespread international activities, which have recently been commented on in these columns. Yet the most important electrical project in hand may prove to be outside the standardisation field: the revision of the BS Code of Practice on electrical installations. Revision, indeed, is too narrow a word for the undertaking. The whole scope of CP 301 is being changed, so that it becomes explicitly a supplementary guide to the IEE wiring regulations. In its new form it will accept these as read, and add information on good practice at a technical level useful to architects, building contractors and the like. In the words of the BSI report, it will aim to be a guide "on the adequate wiring of buildings and the provision of facilities for electrical installations." Already a first draft of the code has been scrapped following fundamental criticism of shortcomings in terms of a consistent technical level, a praiseworthy reaction of a committee charged with preparation of a code which has the potentiality to do so much good. How the "adequacy" aim will figure in the code seems still uncertain. Specific recommendations for numbers of socket-outlets and lighting points will hardly be appropriate, much though they are needed. If the drafting committee can suggest any more general criterion for determining such quantities, they will have done excellently. Meanwhile they must work to some extent under the shadow of knowing that their conclusions may be affected by the Ministry of Housing's current inquiry into standards for domestic buildings. This code is one the industry should watch with the closest attention, for its new form is likely to make it more influential outside electrical engineering than was its predecessor.

TRADE UNIONISTS AS BOARD MEMBERS

A year of negotiations between the Trades Union Congress and the Prime Minister about membership of boards of nationalised industries is recorded in the annual report of the TUC General Council. The main difficulty discussed is that of securing trade unionists as full-time members of boards; pension problems loom large, just as in private industry, and the necessarily terminable nature of board

membership presents a stumbling block. There is less difficulty about active trade union officials being part-time members of boards, although the TUC reserves its position on the principle of whether part-time membership is desirable. What the reported discussions do not cover explicitly is the extent to which full-time members of boards should be recruited from outside the industry concerned. In electricity supply there is an increasing and well-justified trend towards finding full-time board members from the officials of the industry. Coming as they do from a line of promotion stretching back to the junior jobs, these men bring considerably detailed knowledge of problems of concern to trade unionists. If such a spectrum of experience is available to a board, then, as the Prime Minister points out, it can most usefully be supported by men who are currently in touch with developments in related fields, sharing responsibility and influencing decisions through part-time membership. The argument seems to apply as much to having trade unionists on boards as to having industrialists and local authority members.

THE STRANGE CYCLES

The engineer's comfortable familiarity with the steam cycle and the fast-spreading understanding of the fundamentals of nuclear power must never be allowed to suppress interest in other methods of electricity generation. These may be essentially complex ways of improving the efficiency of known methods or entirely new, and technically difficult, approaches. In the former category came the attempts before the war to develop a binary mercury-steam cycle as a contribution to higher thermal efficiency. That failed; the outstanding example in the second class, the fuel cell, is still undergoing development and holding strong promise of success, though with what top rating limitations remains uncertain. The latest claim on the interest of engineers in this way has been magnetohydrodynamics, which holds promise of converting some of the energy in hot gases (such as furnace gases) directly to electrical energy without intervention of the essential inefficiencies of a heat cycle. Although there has been interest in this technique in this country for some years, most of the experimental work has been carried out in America. The path to be travelled is long; apparatus giving 8 kW outputs for short intervals has been demonstrated, whereas rough calculations can show that the method is unlikely to be attractive with ratings below the 100 MW mark. On the other hand, MHD generation could increase the efficiency of nuclear power stations of the gas-cooled type even more effectively than that of fossil fuel stations. Such considerations justify the effort being put into its development.

CONTROL LAYOUT RESEARCH

An article by a psychologist which we publish this week concludes with the refreshingly clear-cut advice that pushbuttons on a control panel should, for optimum mistake-free operation, be arranged horizontally and be not too large, of about $\frac{1}{2}$ in. diameter if the centre-to-centre spacing cannot exceed $1\frac{1}{2}$ in. The important point about these recommendations are that they are based on measurement, on experimental research following the accepted scientific method. Although the electrical industry is thorough in its investigation of the physical detail of designs, it is open to criticism for laxity in applying similar methods to user aspects of its products. Ergonomics or human engineering, to use the terms that have become fashionable, is accepted as a suitable study for user industries, especially where complex operations have to be controlled. The work of the British Iron and Steel Research Association in this field, in relation to steel mill equipment, has been particularly noteworthy in this respect. The electrical industry, however, has to supply standardised control equipment to a wide range of users, many of them industries with no strong scientific background. There is support for the argument that electrical firms should, therefore, apply their familiar routine of test and measurement to making their equipment convenient to use rather than leave the control layout to the common sense and experience of detail design draughtsmen.

TWO-SIDED SCIENCE

Sir George Thomson, the distinguished physicist, has for long demonstrated a willingness to defend the discipline of science against criticisms by some humanists. In his presidential address to the British Association, whose 122nd annual meeting began in Cardiff yesterday, he develops his arguments in telling form. His thesis is that science is two-natured. On the one hand is the commonplace assumption that the sole justification for science is the contribution it can make to increasing man's control over nature. A corollary is that fear of some consequences that can follow such control should have an important place in determining what work should be carried out. Less widely admitted is that science in its aim at understanding the nature of things has a claim to stand equally with religion and philosophy. Unlike these disciplines, it starts from the particular to work to the general, building, as Sir George says, "a pyramid based on many varied facts, topped with a crown of ideas reaching to the skies." The method lends itself to being pilloried when considered in the abstract; but it works. It leads to concepts which are more than convenient summaries of the implication of a mass of details. The concepts that result begin to penetrate into the heart of things. The increase in understanding may, indeed, indicate limitations to the degree to which science can bring control over nature, for that is the implication of many of the recent advances in physics. What is sure, Sir George argues, is that science embraces not merely the control, but also the understanding of nature. And that its two aspects must be held in equal honour.

Meteor

This week's quick summary of electrical news faces advertisement page 13

M.H.D. generation

JOINT STEAM-ELECTRIC CYCLE EFFICIENCY 60%

by R. HAWLEY,* B.Sc., Graduate I.E.E., Ass. Mem. A.I.E.E.

DIRECT methods of producing electric power have been the subject of renewed interest during the last few years. Devices which perform such a function include thermo-electric generators, thermionic generators, fuel cells and magnetohydrodynamic (MHD) generators. Of these, the latter, which generate electricity by the braking of hot ionised moving gases, seem the most promising. Various types of MHD generator have been suggested and tentative studies on thermodynamic cycles performed. Work connected with missile and space problems has developed the beginning of an understanding of the electrical conductivity of gases at high temperatures and enabled experimental generators to be built. Such work has shown the problems involved and points the way to further advances.

In a turbo-generator, chemical energy from the fuel is used to generate steam. The heat energy of the steam is converted into directed kinetic energy, which is used to drive a metallic conductor through a magnetic field producing electrical energy. Such a process is inherently inefficient, due to the losses occurring at each stage of energy conversion with the greatest occurring when the heat energy is converted to mechanical energy. While the inter-conversion of electrical and mechanical energy and the conversion of these forms to heat can take place extremely effectively, there are fundamental limitations on the conversion of heat energy to mechanical energy. In a hot gas, the heat energy resides in the kinetic energy of the molecules which are in random motion. It is the physical impossibility of changing all this random motion into the orderly motion of a rotor that limits the efficiency of conversion.

Production of the steam at higher temperatures and pressures has improved the thermal efficiency, although this in turn has led to more complex plant and higher capital costs. Even so, the overall thermal efficiency of the most efficient power station is only about 40% and any method that shows a possibility of improving this is most important. A suggestion was made years ago, that the required improvement in the efficiency of conversion of fuel energy to electrical energy could be brought about by using heated gases as a conductor, thus cutting out certain inefficient parts of the steam cycle, but it is only recently that it has become possible to base such ideas upon actual experimental data.[1] The basic principle of this type of generation is that the gases are heated by fossil or nuclear fuels, and charged particles are introduced by some means. The gases are passed through a nozzle, thus converting their heat energy to kinetic energy, some of which is extracted and transferred to an electric circuit. Estimates have placed the overall efficiency of such a process, in conjunction with a steam cycle, as high as 60%.

The classes of MHD generators that have been suggested are shown in Fig. 1.

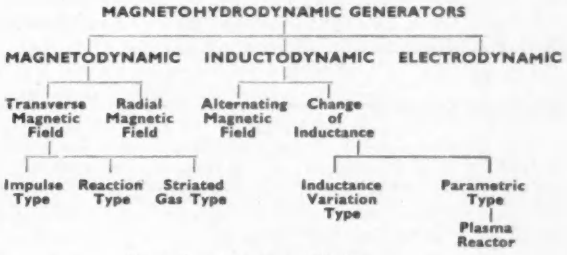

Fig. 1. Possible types of MHD generator

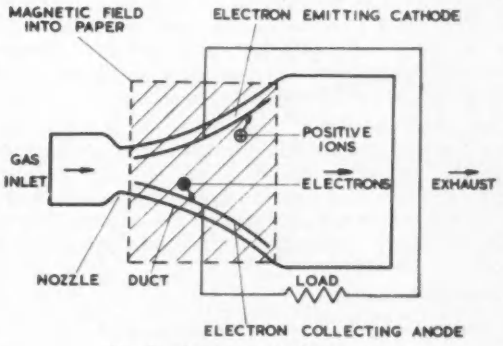

Fig. 2. Transverse field generator

Transverse and Radial Field Generators

In the transverse field generator (Fig. 2), the hot gases are expanded adiabatically through a convergent-divergent nozzle, which accelerates them to a high velocity, and they then pass into a duct. In the duct they pass through a region of transverse magnetic flux provided by an electromagnet, the poles of which are thermally insulated from the hot gases. The electrons and positive ions become separated from one another, and the electrons are collected by electrodes. Electrons have to be injected back into the gases to replace those removed. The actual interaction of the magnetic field and the output current causes a braking effect on the electrons. If the gases are slowed down to one-half their original speed, three-quarters of their energy would, theoretically, be transferred to electrical energy. This type of generator can either have the gases flowing at a constant velocity in the duct, akin to a reaction steam turbine, or the temperature and pressure in the duct could remain constant, as in an impulse turbine. Its principal handicap is that it generates direct current, and for bulk power supplies conversion to alternating current, by means of invertors, would be required.[2,3,4,5,6,7,8,9]

As is seen from Fig. 3, in the radial field generator a radial magnetic field converts the input axial velocity of the electrons into a circumferential velocity, thus

* Mr Hawley is in the Department of Electrical Engineering, King's College, University of Durham.

reducing the axial velocity. Because their mass is thousands of times greater than that of the electrons, the positive ions continue in an axial direction, but they are slowed down due to the coulomb forces acting between them and the electrons. As a result, there arises an axial field along the length of the anode, so that a current can be taken from it.

The alternating radial field generator uses an alternating radial magnetic field to produce a circumferential electron current alternating in direction. If this is made to act as a primary transformer current, it can be coupled into a secondary winding from which the output can be taken. As the energy is extracted by inductive coupling, there is no need for a powerful electromagnet, and a possible saving in weight results.[10]

Plasma Reactor

The plasma reactor is pictured as a long cylinder of refractory material, with a neutron reflector and moderator at each end, filled with a gas containing a fissionable element, for example, U235. The uniformly distributed gas is adjusted so that it is just below the critical concentration. A sudden disturbance causes an increase in amount of fissionable material at one end, which results in a shock wave travelling down the cylinder. Behind the shock wave is a layer of very hot, and hence ionised, gas or plasma. When the shock wave reaches the other end of the cylinder the gas flow will continue until sufficient fissionable material accumulates for the state again to become critical, and the cycle is repeated in the opposite direction.

The electrical power is generated as a result of the interaction of the moving plasma with a magnetic field generated by the curent in a coil of a tuned electrical circuit mounted alongside the cylinder. Oscillations of the circuit are produced by the interaction of the induced eddy currents in the conducting plasma with the currents in the main coil. The induced eddy currents are in such a direction as to give a retarding force on the plasma, and so the electrical oscillations are forced to a greater amplitude at the expense of the mechanical energy of the plasma motion. Rough preliminary estimates show that the maximum operating temperature would be of the order of 6,500°K, giving a power output of 480 MW at about 20 c/s, with a cylinder length of 46 metres and an overall power plant efficiency of 20%. The estimated thermodynamic efficiency is 30%.[11]

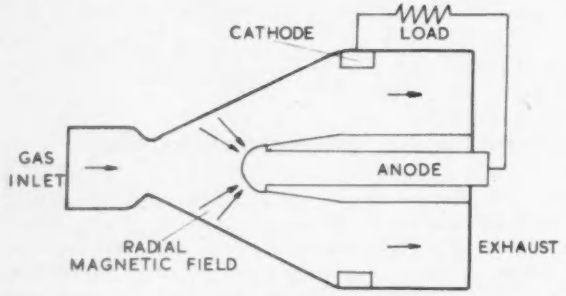

Fig. 3. Radial field generator

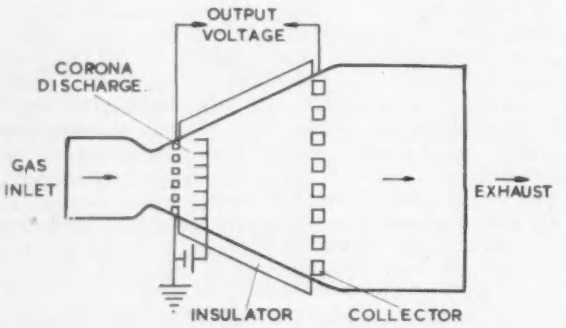

Fig. 4. Electrodynamic generator

Electrodynamic Generator

The electrodynamic generator as shown in Fig. 4 is similar to the conventional Van der Graaff machine in which moving gases replace the belt. Advantage is taken of the high dielectric strength of the gases, even at high temperature, to work at very high voltages. If the gases contain positive ions they will be carried along by the stream and may be collected in a trap, which will become raised to a high potential. The charge would be contained in a volume instead of a plane, thus reducing lateral fields and the possibility of breakdown. Turbulent flow of the gases up to seven times belt speeds should be possible and the generator would supply relatively large currents at high potentials in comparison to the Cockroft-Walton and Van der Graaff generators.

The charged particles can only proceed against the voltage gradient by replenishing their kinetic energy from their uncharged neighbours in their deceleration path. Thus, design voltages must be high in order that the fast-moving gases be slowed appreciably, for this slowing is proportional to the voltage of the collector. A number of collisions approaching 1,000 would be sufficient, without running more than a negligible risk of avalanching. The main disadvantage lies in the fact that ions diverge to the walls of the tube by mutual repulsion, which is serious for efficient transmission of ions down a long tube.[12,13]

Thermodynamic Cycles

The basic thermodynamic cycle suggested for magneto-dynamic generators is similar to a gas turbine cycle in which the turbine of the turbo-compressor is replaced by a nozzle. The maximum possible efficiency is the Carnot efficiency, which is given by $(T_1-T_0)/T_1$

where T_1=Absolute temperature of the gases before expansion

T_0=Absolute temperature of the heat sink.

The highest possible flame temperature of low grade fossil fuels, even with preheating, is about 3,000°K and if T_0, the temperature at which heat is rejected, is 300°K, although normally it will be higher than this, Carnot efficiencies in the range 0·75 to 0·90 are possible, compared with 0·45 to 0·65 for present-day heat engines. The overall thermal efficiency tends to be a given fraction of the Carnot efficiency, hence the importance of raising the initial temperature is apparent. A secondary steam cycle would be used to extract the majority of the energy left in the partly expanded exhaust gases. It is to be noted that any power dissipated in the internal resistance of the generator or as friction between the gases and the walls of the duct is still available as heat energy, with the exception of that lost through the walls, to do work in the secondary steam cycle.

A tentative open cycle for a reaction-type generator is seen in Fig. 6. The cycle flow rate was chosen to give 450 MW output. Atmospheric air is compressed to 10 atmospheres and heated to 2,250°K in a regenerative air

heater. Coal combustion is used to raise the temperature to 3,200°K. The gases are seeded by introducing a small amount of an alkali metal (for example, potassium) to improve their conductivity and travel through the MHD generator developing 365 MW of direct power. The hot exhaust gases at 2,600°K flow through the regenerative heaters, cool to 1,400°K and pass on to the boiler. Here they are further cooled to 420°K, and the heat energy thus obtained used to generate steam, which, in a conventional steam cycle, supplies a further 107 MW of alternating power, plus the power to drive the compressor. Due to high operating temperatures the heat rate is about 6,200 B.Th.U./kWh, a 25% improvement on the most efficient steam plants. The efficiency is estimated to be about 55%. Preliminary estimates have shown that, per kW, the capital cost of an MHD unit, including quite high inversion costs, should be about the same as a conventional unit.[14]

A nuclear fuelled cycle would be identical to the coal-powered open cycle, with the exception that the working fluid would flow in a closed cycle at lower temperatures but with better conductivities. It is at present impossible to obtain nuclear reactors that give rise to temperatures as high as coal furnaces, but gas temperatures of up to 2,750°K may ultimately be achieved. Such a cycle may well be easier to develop than the fossil-fuelled open cycle, for an inert non-corrosive gas, such as helium or argon seeded with caesium, could be used, allowing a greater choice of materials. The efficiency of this type of cycle has been estimated at about 60%.[15]

Conductivity of Gases

The heating of a gas to a high temperature at a low pressure enhances the dissociation of the atoms into ions and free electrons. In fact, at temperatures of the order of 10⁷°K, a plasma is formed which has a greater conductivity than metals at ordinary temperatures. However, the actual temperatures used are far below this and so the required degree of ionisation must be obtained by auxiliary means.

The conductivity of a gas is proportional to the electron density and the electron density resulting from thermal ionisation is given by Saha's equation:

$$\text{Log}_{10}(n_e^2/n) = (3/2)\log_{10}T - 5040(V_1/T) + 15{\cdot}38$$

where n = neutral particle density

n_e = electron density

T = absolute temperature

V_1 = ionisation potential.

For a given temperature, the strong dependence of the electron density on the ionisation potential is easily seen. In a device burning fossil fuels, the ionisation potentials of the equilibrium flame gases (O_2, O, N_2, CO_2, CO, OH, H, H_2, H_2O) are between 12 and 16 electron volts. Estimates based on the heats of formation and specific heats of the products show that an upper limit of 3,000°K can be set on the flame temperature, so that ionisation would be negligible in this region. However, the addition of a small concentration of alkali metals such as sodium (5·14eV), potassium (4·33eV) or caesium (3·88eV), having much lower ionising potentials, leads to a disproportionately high increase in conductivity. In Fig. 5 is shown a range of data for gases at different pressures seeded with 1% potassium.

The percentage of charged particles in the gases is still extremely small. Since these particles alone react with the extracting fields, a mechanism must exist whereby the uncharged particles can give their energy to the charged particles and hence to the electric circuit. Unless this is so, the efficiency of conversion could be no greater than the percentage ionisation of the gases. In the case of a metallic conductor, any retarding force on the electrons is transmitted to the positive nuclei by attraction forces, and since the nuclei are fixed in the crystal lattice, energy is extracted from the complete conductor. In a gas this is not so, and any energy transfer can only result from attraction forces and collisions between particles. It is not yet certain what the exact mechanism of energy transfer between the particles is.

Experimental Generators

An experimental 10 kW magnetodynamic generator is shown in Fig. 7. It consists of a plasma jet mounted above a magnet. The magnet with the MHD generator channel between its poles is supported by a tank which confines the exhaust and is vented to the roof. Helium

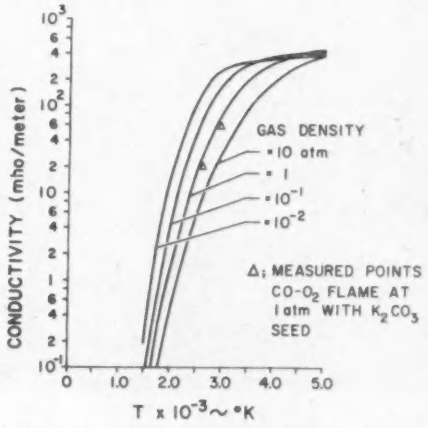

Fig 5. Variation in conductivity of air plus 1% potassium, with temperature and pressure

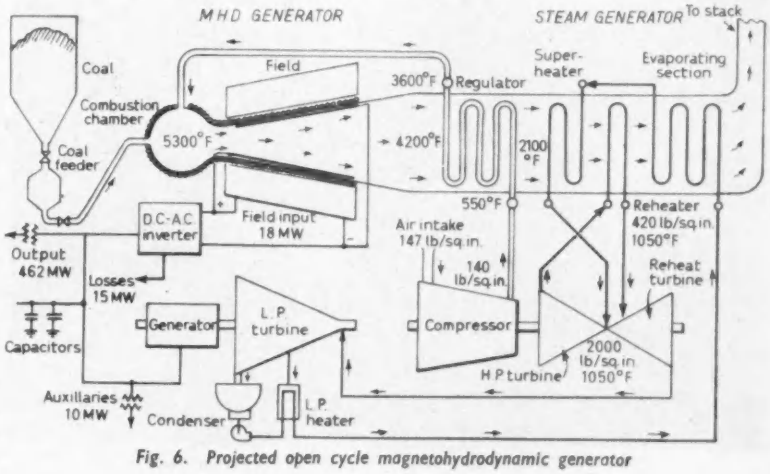

Fig. 6. Projected open cycle magnetohydrodynamic generator

and argon have been used as working fluids, seeded in each case with one atomic percent of powdered potassium carbonate. The generator consists of an insulated channel 1 in. by 3 in. by 20 in., electrodes and a magnetic field of 1·4 Wb/sq m. Conductivities ranged from 80 to 150 mho/m. With argon seeded with 1% potassium, a flow rate of 0·3 kg/sec, a temperature of 2,800°K and a Mach number of 0·7 the peak output was 430 A at 27 V. Due to a lack of suitable cooling the maximum length of a run was limited to about 10 seconds.[16] Elsewhere, using similar techniques, 1 kW was obtained for five seconds from a plasma jet created by an air arc with an open circuit voltage of 30·4 volts.[17]

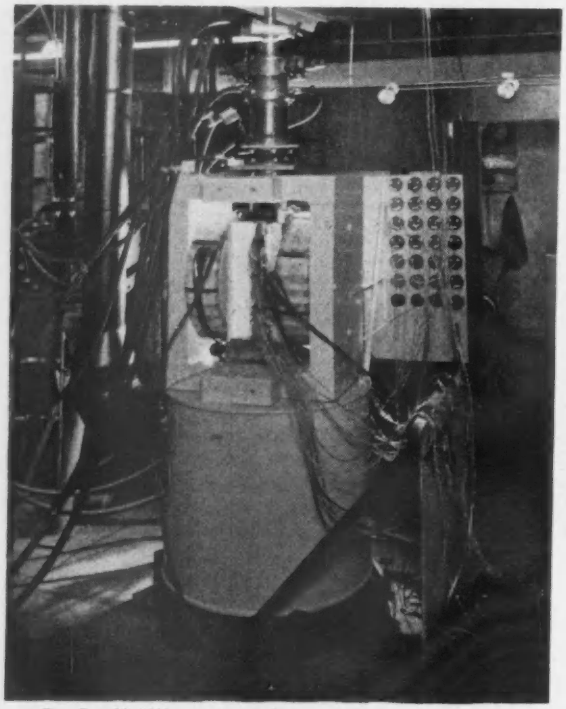

Fig. 7. 10 kW experimental generator using a plasma jet

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The first experimental generator to operate on combustion products, rather than electrically heated gases, is seen in Fig. 8, the magnet being shown in a lowered position. This generator uses the products of combustion of furnace oil and oxygen and these are seeded with potassium. It has developed 8 kW of direct power and has been run on load for as long as five minutes continuously.[7]

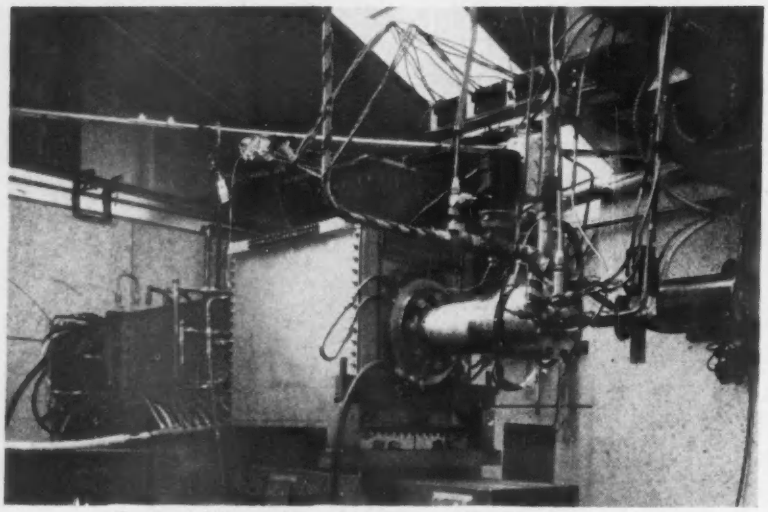


Fig. 8. 8 kW experimental generator using combustion products

Experimental work on electrodynamic gas flow generators has also been reported. In a single stage 15 cm diameter ion tube with an air velocity of 130 m/sec, 75 microamps at 80 kV were obtained. There is some evidence that at gas velocities of the order of 200 m/sec very much larger currents would be possible. Such devices could be connected in series to form multistage machines of output limited only by the insulation of the collector but additional blower power would be required to produce the increased electrical output. Experimental

results and considerations of current and length indicate that the blower power must be at least 25 h.p. with the possibility that the optimum power level is about 1,000 h.p. For power generation where high voltages are not required the stages may be connected in parallel to obtain larger currents at some medium voltage, for example 100 kV.[12, 18]

Conclusions

Magnetohydrodynamic power generation could well be a solution in the search for higher thermal efficiencies. For this reason it is necessary for experimental and theoretical work to continue so that all its possibilities are fully investigated. Besides the advantage of higher efficiencies resulting from operation at high temperature, generators of this type would have a reduced weight due to fewer and more compact components, higher reliability as they contain no moving parts, lower capital costs and fuel costs, and would relieve cooling water and siting problems. Specific outputs would be greater and while the generators may be physically large they would produce a great deal of power for their size. It does not seem likely that at power outputs below a megawatt MHD generation will prove competitive to present day commercial plants, but at outputs of 100 MW and above they may show appreciable superiority. Besides acting as topping devices to improve the efficiency of turbo-alternators generating base load power, MHD generators may find application as electrostatic devices; and as space generators, powered by solar energy, fusion devices or rocket exhaust gases, in view of their low weight to 100 kV.[12, 18]

Acknowledgements

The author wishes to express his thanks to Professor R. L. Russell for his interest, Dr B. C. Lindley (C. A. Parsons and Co. Ltd., Nuclear Research Centre) for extremely helpful advice, AVCO Everett Research Laboratory for permission to republish Figs. 5, 6, and 7, and Westinghouse Laboratories for permission to republish Fig. 8. (*References on page* 304.)

AUTOMATIC TESTING FOR SWITCHES

COLD cathode triodes are used by GEC instead of mechanical relays in an automatic testing jig developed for use in the production of domestic switches. The jig operates at a rate of one switch per second, distributing faulty switches to separate bins according to the nature of the fault. The switches are tested at normal voltage and also at 20% over-current.

The cold cathode tubes used are neon-argon filled devices which can be triggered to give a glow discharge which will continue until anode volts are substantially reduced. Logic circuits are built up by means of rectifier gating circuits connecting tubes or groups.

Tests Applied

The jig is intended for use with "Clipper" switches, the latest addition to the company's "Mutac" range. Four tests are applied to each switch, to prove:

(1) That the circuit is made with the switch in the closed position.

(2) That the switch does not break the circuit too early in its travel.

(3) That the switch does break circuit.

(4) That the switch will remake the circuit, and the dolly will return to the ON position by itself from the point of break.

In designing the jig, particular difficulty was presented by the requirement of checking that the circuit should be broken at a point not less than 3° from the at-rest position of the dolly. Manufacturing tolerances make the at-rest position a variable quantity so this has to be determined before movement is measured. The remaking test also involved difficulties. To overcome the first problem, a mechanical method was used for fixing the at-rest position without involving travel of the test mechanism to which the electronic circuit responds. Operation of the switch is then by pneumatic means.

Switches are loaded on to the jig in batches of 32. Cold cathode triodes are connected so that if the correct responses are not obtained from a switch, an ejection solenoid is operated to remove the switch, and a trap-door to drop it into the appropriate reject compartment is opened. The cold cathode tubes are used in a voltage transfer arrangement, in which presence or absence of signals on intermediate tubes controls the passage of signals throughout the circuit. A basic circuit is used in which groups of tubes are made mutually self extinguishing by use of a common resistor with capacitor and a series resistor in parallel with the cathode resistor.

Ejection of a switch because it is faulty resets the jig and the logic circuits ready for the next switch.

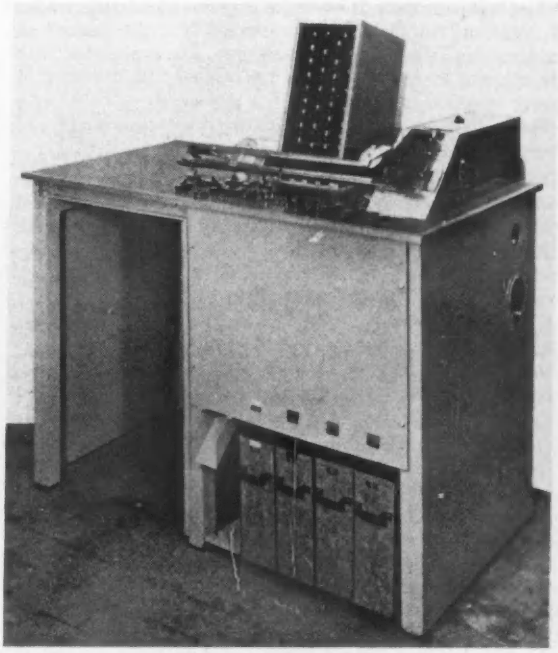


Fig. 1. GEC switch testing jig

Electrical standards, 1959–60

ANNUAL REPORT OF BRITISH STANDARDS INSTITUTION

CONTINUED acceleration in the pace of standardisation work is apparent from the report of the British Standards Institution for the year ended 31 March last; and in electrical engineering the speed of advance appears even faster than in other sections of industry. The newly published report brings out the increasing effort necessary to service the international standards committees, which are so growing in their influence on export trade prospects.

Standard Difficulties

In its section of electrical engineering, the report well illustrates the difficulties that beset preparation of standards based on general agreement. For instance, the work in drafting a new standard for armoured p.v.c.-insulated cables has been hampered by a controversy about the way of publishing the standard. The proposal was that the new standard should cover all armoured p.v.c.-insulated cables, but some people argued that it should be confined to cables for electricity supply, with all other p.v.c. cables, armoured or not, dealt with in another standard. A compromise has been suggested whereby cables of special interest to the supply industry will be shown as preferred sizes and types.

Another controversy has arisen in the difficult field of classifying gases for the purpose of flameproof enclosure certification. For long methane has been the sole occupant of Group I, but there is evidence that the present allocation of ammonia to Group II is unrealistic. At present, a reassessment is being made, with ammonia associated with (though not placed in) Group I. However, the Ministry of Power want to keep Group I for mining gases only, so a problem has arisen about what to do with ammonia and gases such as industrial methane.

One idea is that a new grouping shall be devised, to take account of whether equipment is to be used in mines (Group I) or on the surface (Group II). Enclosures for Group II equipment would have graded gaps to give safety with various gases.

Another cause of delay in standardisation arises when tests that seem reasonable at first prove unacceptably severe in large scale practice. This has happened with a new standard for insulator and conductor fittings, and the draft standard is being recast. Again, preparation of a standard can reveal a lack of precise information which points the need for more experimental work to provide a rational basis for requirements. Thus, although tests by the ERA have shown that a method of proving dust-tightness of enclosures is practicable, the Association has been asked to make a further report on one particular condition, cyclic heating and cooling, which was not covered in the original investigation. The BSI report comments that a standard for dust-tight enclosures is expected to be extremely valuable; several previous attempts to find a basis for agreement on such a standard have proved unsuccessful.

Amongst standardisation work of general electrical interest during the period reviewed was a revision of the standard dealing with marking and identification of busbars and small wiring. It is hoped this will banish inconsistency between the IEE wiring regulations, some standards for cables and that for marking busbars. An important element here is elimination of the use of white as a phase colour alternative to yellow. Another irritating field of small discrepancies is in the voltage designation of cables. A special committee has been set up in an attempt to devise a uniform system of marking.

Connectors

Plugs, sockets and connectors have been one of the most obvious targets for standardisation, but debate on various aspects continues. A failure in international negotiations is reflected in the decision announced, to proceed with publication of a British Standard on connectors for portable appliances, although this will not be acceptable in European countries. This disagreement, in CEE, already announced, has arisen because one of the ratings in the British design for a non-reversible connector could accept the pins of a type of plug used in many European countries.

Another project in the connector field is revision of BS 196, reversible two-pin plugs and sockets with earthing connection. It has been decided to recommend standard positions of keys and keyways in the plugs and socket-outlets to provide discrimination between different voltages and frequencies. Keys are also to be used to discriminate between plugs with and without fuses.

The illumination division of BSI has started work on a standard for lighting fittings intended to cover all general-purpose fittings for discharge and filament lamps. It is to be drafted in such a way that it can be extended later to cover many special lighting fittings not included in other standards. Work has also started on drafting standards for special lighting units and fittings used in hospitals.

Codes of Practice

The code of practice on street lighting is under revision at present, with the intention that it will apply as a whole to all roads, instead of dealing with traffic routes and other roads in separate parts, as in the present edition. A new classification of roads for lighting purposes is under consideration.

Also under revision is CP 321, covering electrical installations. It is intended that this in its revised form should act as a supplementary guide to the IEE wiring regulations on the adequate wiring of buildings and the provision of facilities for electrical installations. The revised code is to be limited to buildings other than large industrial buildings and to installations operating at medium voltage.

The report also summarises work on the CEE and IEC international committees in the electrical field, and notes the continued expansion of other BSI activities.

Design of pushbuttons

ERGONOMIC FACTORS IN CONTROL ARRAYS

by L. R. C. Hayward, Dr.Psy.(Leyden), M.A., B.Sc.

ALTHOUGH many years have passed since push-button controls were first introduced into the design of electrical and electronic apparatus, a cursory inspection of radio sets and equipment shows that manufacturers are not yet taking advantage of all that is known about the design and placement of the push-buttons themselves. While it is perhaps true that in the home, time is available for selecting the correct control, and mistakes can be readily corrected, the same cannot be said in the case of many industrial and scientific applications. While automatic cutouts and multi-circuit controls can be included in the design to prevent damage following errors in control, in some circumstances, for example, in high speed flight, such precautions may save the apparatus but not the situation. Internal safety devices are of little consolation when there is no time left to rectify human error!

Fortunately for those personally and immediately concerned with such problems, psychological and ergonomic staff are available to experiment and advise on these matters. Because of this, the introduction of control and communication equipment into the co-ordination of man and the military machine has been accomplished with the maximum of efficiency. At Farnborough two independent units of the Army and Royal Air Force have had the opportunity to study human requirements in push-button design at all speeds within the range of the slowest armoured vehicle and the fastest supersonic aircraft. While the Official Secrets Act prevents much of their work from being published, sufficient information on the psychological problems involved in push-button control have been made available from independent laboratories to justify a brief survey of the facts that are known.

Unless other factors in the manufacturing process are more important, it seems reasonable that manufacturers and their design staff should take advantage of known psychological factors, in order to provide as high a degree of consistency as possible between designs for the domestic market and those for industry and the armed forces. This will not only benefit the consumer, but will be of distinct advantage to the serviceman, who will be able to carry with him to his military duties, habits of operation unconsciously acquired at home or in his civilian career.

How to Arrange Controls

The basic problem is the display format—should the switch system be monolinear or multilinear, vertical or horizontal, grouped or ungrouped? The advantage of the monolinear placement of controls has been known ever since the accordion graduated to the piano-accordion—experiments on the time required to play, *ab initio*, on the piano keyboard or on the push-button bass prove unequivocally that human hand movements are both more accurate and faster on a single line display than on any multiline system.

When the display consists of only a few units, the difference in operation efficiency betwen the two alternative types of display is often insignificant, for quantitatively the difference rises as a mathematical function of the number of units present. This function is not a linear one, since, above a certain limit the size of the display relative to the radius sweep of the fore-arm will introduce new factors—the jack-socket display on a branch exchange telephone switchboard is a good example of this. Within the limits imposed by human anatomy, then, it is preferable to apply consistently the principle of monolinearity as far as the overall design of the control panel will allow.

Vertical or Horizontal?

Should they be vertical or horizontal? Here the experimental data is clear: even with only three buttons the horizontal arrangement is significantly more efficient than the vertical one. This has been verified independently on a number of occasions, for it carries important implications in cockpit design, where failure to push, for example, the canopy ejection switch first time could prove fatal. Experiments have been carried out on three independent measures, namely, the time to select and press the correct button of three, the number of times the wrong button has been operated in error, and the number of times the operator has inadvertently pressed an adjacent button as well as the correct one. Each time the horizontal display has prove measurably superior.

It is not difficult to see why this should be so: the eyes are also set horizontally. In traversing a set of vertically positioned pushbuttons, both eyes feed into the brain identical information by means of the movement of the oculomotor musculature. In the horizontal traverse, on the other hand, the arc subtended by the sweep of each line of sight from left and right eyes, respectively, will in most cases be different. The appropriate efferent area of the brain will thus receive not only information concerning the total distance rotated by each eye, but by means of the association areas will also record the differential movement of the two eyes. Horizontal traverse thus provides a subtle two-channel communication compared with the single channel used in vertical traverse. The accuracy of human response is always proportional to the total amount of information available—this is why information theory and cybernetics are so important in equipment design—so that any system which increases the number of channels and/or the total amount of information is the system of choice when other factors are equal.

Grouped or Ungrouped?

The question of grouped versus ungrouped controls can only be answered with due regard to the particular purpose of the apparatus. Studies on this aspect of control panel design have not given a very clear answer in so far

as any general recommendation can be made. Accuracy is certainly higher with ungrouped controls because this factor is also a function of spatial separation, but some speed of operation is lost, particularly when unilateral manipulation is required. For the domestic market especially, cleanness of design and due regard for symmetry are more important than a minute and valueless increase in operating efficiency.

Even in the design of military equipment, the principle of control grouping is accepted on various grounds of expediency; for example, a 48-switch unit for bomb selection was adopted as standard equipment for a certain type of heavy bomber during World War II, even though some of these switches were required for uses other than bomb release, or were not required at all. While it was shown that flare releases were more efficiency operated when separate from bomb releases, the gain in efficiency was not sufficient to justify the overall loss in efficiency resulting from different types of panel display. This balancing of overall efficiencies is a complex problem which many instrument designers have to face, but it is always made easier when accurate data are available as a result of psychological experiments.

Size and Spacing

Touching errors are the most important sources of mistake in military push-button controls, and it is therefore interesting to see in what way push-button design can reduce their frequency. Experiments show that there are two ways of doing this. Either the intercentre distance can be increased, or the button diameter can be decreased. In the former case there are two separate ways of effecting the intercentre increase, holding either the button diameter or the edge-to-edge space constant. Both reduce touching errors, but the latter has little effect upon operating time. The former not only reduces touching error frequency, but brings about a rapid improvement in operation time, and is the method to be recommended.

The US Air Force have been interested in these findings, and by a series of trials under operation conditions have sought to determine the best sizes of knobs and best intercentre spaces. No final recommendations for spacing have so far been made known, since in most cases other variables prove to have overriding importance, as in the example of the bombswitch grouping. Findings on button diameters are less equivocal, however, and these suggest that if controls can be no more than 1·5 in. between centres, then 0·5 in. is the optimum button diameter, but if intercentre spacing of over 2 in. is permissible then 1 in. diameter buttons prove to be as efficient as the smaller ones. With the necessity to standardise as many components as possible, it seems likely that the ½ in. button may win the day, although so many American sets and control units have smaller button diameters, notably the ¼ in., that there may be some initial resistance from manufacturers.

In this country the problem is somewhat different, but the advantages of standardisation remain. If we can use these recommendations to peak efficiency: monolinear grouping, wide spacing, and horizontal arrangement, preferably with ½ in. diameter buttons, we are not only providing the operator with the best in control panel design, but we are contributing to industrial progress and imperial defence in some small, but nevertheless, cumulative way.

Supply in New South Wales

DEVELOPMENTS in transmission techniques in recent years have caused a reversal in the approach to economic siting of power stations in New South Wales. The annual report for the year ended June, 1959, which has only recently become available, shows how the decision to site new power stations in the coalfields and use long transmission distances rather than the earlier policy of transporting the coal to the industrial centres, has made possible a substantial reduction in cost per unit.

At the beginning of January, 1959, the cost per unit was reduced by 0·05d as part of an average price reduction per kWh over the 1958 financial year from 1·762d to 1·679d.

During the period covered by the report, the Commission showed a surplus of £87,802 on a total income of £44,929,573. This surplus was about 2% lower than for the preceding year. It is estimated that the reduced price per unit represented a saving to consumers of £1,400,000.

Sales Increase

Sales increased by 9·8% during the year to 6,372,835,992 kWh and the addition of 132·4 MW of generating plant brought the total capacity of the State power stations to 1,816 MW. The Commission had a further 520 MW of plant under construction or on order at the end of June last year, including two 200 MW and two 100 MW sets. The 200 MW sets are to be installed at Vales Point power station, where site preparation began during the year. Construction work progressed on four other thermal stations and two hydro-electric plants.

The first 330 kV section of the Commission's network was completed in May, 1959, when the 84-mile line from the Snowy Mountain's T1 station to Yass switching station (ELECTRICAL TIMES, 10 September, 1959) was commissioned. A further 200 miles of 132 kV lines was also brought into service during the year, some of which is scheduled, eventually, to operate at 330 kV.

Stabilising Condensers

Improvements in system stability resulted from commissioning of the last two of four 20 MVAr synchronous condensers at Carlingford substation. Static capacitor banks totalling 60 MVAr were also brought into service at three other 132 kV substations.

The Commission operates an extensive communication system which includes power line carrier equipment. In the year under review, two micro-wave links were installed to assist supervision of the 330 kV line.

Interconnection and power transfer with the Snowy Mountains scheme and the State Electricity Commission of Victoria have emphasised the need for load-despatch equipment. Such equipment was being installed in 1959 for load frequency control. The first of its kind in Australia, this equipment will automatically compute the most economical arrangement of plant loadings and will regulate power station output and system frequency. Until the equipment is installed, a computer designed by the Commission's staff is being used.

Automatic voltage regulators for ships' auxiliary systems

by W. J. R. Farmer,* B.Sc.

Part 1

THE past ten years have seen a steady increase in the application of a.c. power for auxiliary supplies on new ships of all types. A number of entirely new problems have arisen from the change, an important one with which we are concerned here being the maintenance of a steady voltage on the ship's busbars.

D.C. generators of the type formerly used for the ship's supplies have a relatively steady voltage, and compensation can be made for load changes by suitable series field compounding. The characteristics of an alternator are entirely different, this type of generator having inherently very poor voltage regulation at constant excitation. Further, we now have to contend with the additional complication of load power factor which, in the extreme leading case, can actually cause a rise in voltage, and when lagging may cause the voltage to fall to less than 50% of its nominal value.

It will be seen that an effective voltage regulator is essential and it must have the properties tabulated below—some of which are peculiar to marine conditions:

1. Steady state voltage control under all load conditions to within $\pm 2\frac{1}{2}\%$ or better.
2. Fast response to sudden load changes to minimise transient disturbances.
3. Must permit parallel operation of generators.
4. Must be able to withstand severe vibration.
5. Operate satisfactorily in high humidity conditions at temperatures up to at least 50°C.
6. Must not be affected by oil vapour.
7. Should require virtually no maintenance.
8. Must be simple to operate.
9. Must be easily replaced or serviced in the event of a fault.

It is proposed to discuss here a range of voltage regulators which are available for marine applications. To permit proper appreciation of the various regulators some of the essential theoretical considerations will first be considered.

General Theoretical Considerations

In simplified block form the diagram of any type of automatic closed loop voltage regulator is as illustrated in Fig. 1. The basic system employed comprises two elements: (a) A voltage-measuring device in which the generator terminal voltage is compared with a fixed reference which may be an electrical constant voltage element or a mechanical device such as a spring. (b) A regulating circuit or amplifier. The voltage-measuring circuit produces a signal known as the error, which is a measure of the departure of the generator terminal voltage from the reference. This error acts upon the regulating circuit, causing it to adjust the generator excitation in the correct manner to maintain constant terminal voltage.

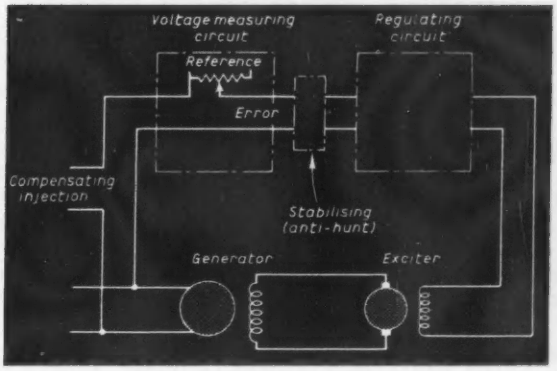


Fig. 1. Basic block diagram for automatic closed-loop voltage regulator

To take a simple numerical example, consider a regulator required to have 2% voltage droop between no load and full load on the generator. The change in exciter field excitation required from no load to full load is from 10 V to 50 V to maintain the terminal voltage within 2%. If it is assumed that the reference is a fixed 100 V the following figures can be written:

	Exciter field voltage	*+ Reference voltage*	*− Generator voltage*	*Error voltage*
Generator on no load ...	10	100	99·5	0·5
Generator on full load ...	50	100	97·5	2·5

The percentage error between no load and full load is (2·5−0·5)/99·5=2% approximately. It will be seen that the regulating circuit must have a gain of (output change)/(error change)=(50−10)/2·5−0·5)=20, and, further, the accuracy of voltage control is directly dependent on the value of the gain.

The above considerations were confined to steady state conditions in which the voltage regulator was assumed to have had time to settle down after any load change. Transient conditions immediately following a sudden change in load are of a different nature determined largely by the generator characteristics.

An a.c. generator may be regarded as a source of alternating e.m.f. (proportional to the excitation) with a "reactance" in series with the output terminals as illustrated in Fig. 2(a). This reactance is a composite quantity comprising three main effective reactances—sub-transient, transient and synchronous.

The significance of these reactance components on the transient performance is illustrated in Fig. 2(b). Here, the dotted curve shows the effect of sudden load application on a generator operating at constant excitation with no automatic voltage regulator. The terminal voltage drops in three stages, first the instantaneous drop proportional to the sub-transient reactance followed again almost instantaneously by a further drop to a value proportional to the transient reactance. Finally, the voltage falls com-

* Mr Farmer is with AEI Electronic Apparatus Division. This article is based on a lecture in a course on Alternating Current for Ships' Auxiliaries, held at the Royal College of Science and Technology, Glasgow.

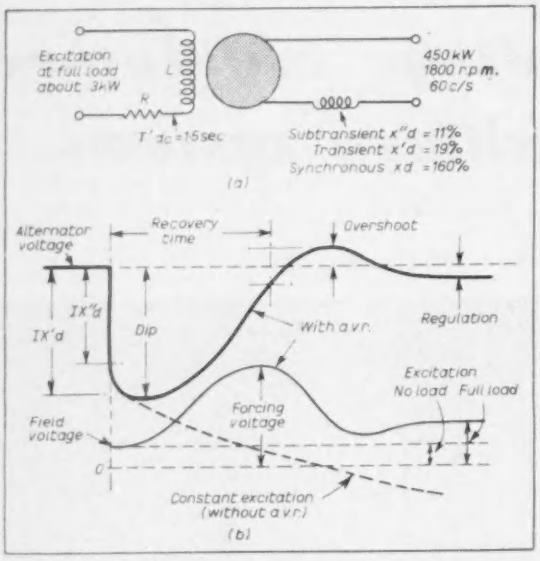


Fig. 2. Transient performance of a.v.r. (a) Characteristics of typical alternator. (b) Significance of reactance components shown in (a) in transient performance

paratively slowly to a very low figure proportional to the large synchronous reactance. The first, sub-transient reactance step may usually be ignored.

A fast-acting voltage regulator will rapidly increase the generator excitation as soon as the initial voltage drop appears. It is evident that the faster the regulator can be made, the less will be the maximum voltage dip; though in the limit the dip cannot be less than that due to the transient reactance. In practice, it is found that a system having a voltage recovery time of 0·5 seconds gives an initial dip very little greater than would be expected from the transient reactance alone.

In a.c. ships an appreciable economy can be achieved in the electrical plant by the use of a fast-acting voltage regulator. The fact that the voltage dip is minimised permits large motors to be started direct-on-line with a relatively small generator rating and without excessive disturbance to other plant and with minimum flicker on lights.

Field Forcing

It must be remembered that, in spite of the possible high response rate of voltage regulators, the generator field has considerable inductance and even with an instantaneously applied field voltage the field current can only build up exponentially in accordance with the formula $i=\{V/R\}\{1-\exp(-Rt/L)\}$ where i is the current, t seconds after the application of voltage V. L and R are the alternator field inductance and resistance, respectively. It is evident from the above that if V (known as the field-forcing voltage) can be made large the rate of rise of excitation current can correspondingly be increased. To achieve a speed of voltage recovery of 0·5 seconds it is frequently necessary for the excitation system to be capable of giving a momentary voltage of 2·5 times the full load excitation voltage. Fig. 2(b) shows the form of the alternator field and a.c. terminal voltage during sudden load application.

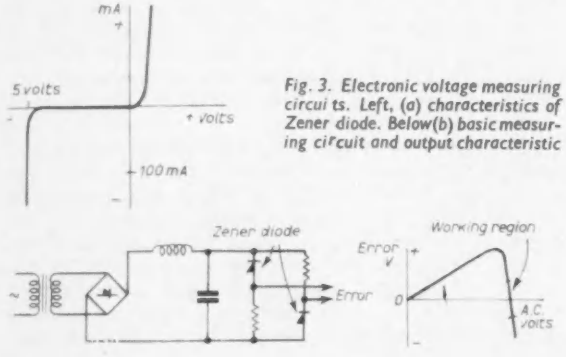


Fig. 3. Electronic voltage measuring circuits. Left, (a) characteristics of Zener diode. Below(b) basic measuring circuit and output characteristic

Voltage Measuring and Regulating Circuits

A large number of different methods of measuring the generator terminal voltage by comparison with a reference are available, therefore a few of the most widely used circuits only will be described.

Mechanical voltage measuring circuits. This form is common to all earlier types of voltage regulator. The generator voltage is applied to a magnet coil or torque motor which produces a mechanical force proportional to the generator voltage on an armature. This force is opposed by the pull of a control spring which is the reference element. A voltage deviation from the normal balance condition causes the armature to move and this movement or "error" quantity actuates the regulating element, which takes the form of a special variable resistor in the field circuit. The change in excitation produced in this manner restores the generator to normal voltage. Two circuits of this type are mentioned later in Figs. 10 and 11. (Part 2 of this article.)

Electronic voltage measuring circuits. The most common circuits are in the form of four-arm bridges, two arms of which are fixed resistances and the other two are non-linear resistances whose value depends on the applied voltage. A number of forms of such resistance are available, including special filament lamps, metrosil units, and, most recently introduced, the Zener diode.

The Zener diode, being the most promising of recent developments in voltage measuring circuits, will be described in some detail. Of conventional silicon rectifier construction the diode has a characteristic as shown in Fig. 3(a). In the forward direction the current rises sharply as soon as the voltage exceeds 0·5 to 1·0 V as for any normal rectifier. In the reverse sense, this being the normal operating region, very little current is present until the voltage reaches the Zener point at which breakdown takes place and the current rises sharply. This Zener voltage is extremely constant and its value is determined by the manufacturer according to the form of silicon employed, 5 V is a common value. A typical circuit is shown in Fig. 3(b).

Magnetic voltage measuring circuits. Two main types of such devices are available and will each be briefly described. Both are robust and reliable components but may well in the future be replaced by Zener diodes.

Saturating reactor. The reference element comprises a reactor employing a high grade core such as HCR. This gives the reactor a sharp saturation knee, i.e., as the applied voltage is steadily raised, saturation occurs suddenly and further increase in voltage causes a rapid rise in current. Figs. 4(a) and 4(b) show the form of characteristic of such a reactor together with a typical circuit. It will be seen that the saturation voltage of the reactor, which forms the voltage reference, is very dependent on supply frequency, therefore frequency compensation is necessary. The error output characteristic is similar to that of the Zener diode circuit.

Constant current reactor. The reference element in this case is a special reactor which has the property

of passing constant current for a wide range of a.c. supply voltage. The device is constructed in the manner shown diagrammatically in Fig. 4(c) which also shows the form of its electrical characteristic. The level of the constant current plateau is entirely dependent on the degree of magnetisation of the permanent magnet and, therefore, forms an accurate current reference which is insensitive to supply voltage and frequency changes. A typical circuit employing this form of reactor is shown in Fig. 4(d) together with the output characteristic.

Regulating circuits (error amplifiers). It has previously been mentioned that the small output from the voltage-measuring circuit must be amplified to a power level suitable for controlling the generator excitation. This amplification may be produced in several different manners of which the most common will be described.

Mechanical. These take the form of mechanically operated special variable resistors in series with the exciter field; specific arrangements will be considered later in relation to actual voltage regulator designs.

Electronic valve. This method of amplification has proved very successful in the past for excitation control, large radio-type valves being used for low excitation powers, and thyratrons for high powers. For marine applications, valves have largely been superseded by magnetic amplifiers which, though having no advantage in performance, are regarded to be more robust, more reliable and of longer life.

Magnetic amplifier. The magnetic amplifier is the most common regulating element used in modern voltage regulators and merits a detailed description.

The amplifier consists of a saturable reactor and a set of selenium or semi-conductor rectifiers. Two typical circuit arrangements are shown in Fig. 5. These circuits have similar performances and differ only in the rectifier arrangement. It will be seen that the input or control signal (at a low power level) is applied to a control winding on the reactor. The output to the load is d.c. and bears a relationship to the control current of the form shown in Fig. 6.

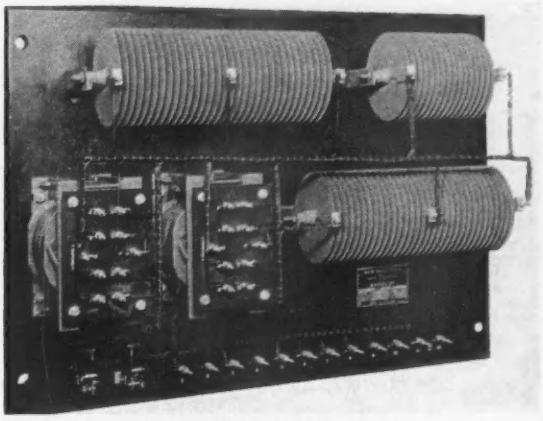


Fig. 7. 350 W magnetic amplifier

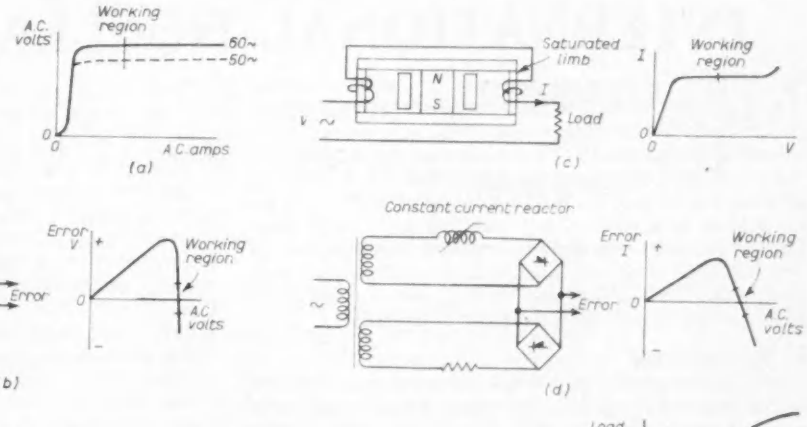
Amplifiers of this type can be made of any size to suit the machine excitation. When the output power approaches 100 W it usually becomes necessary to use a two-stage amplifier.

Unlike valves and transistors, magnetic amplifiers have an appreciable time delay between input and output and careful design is necessary to minimise this delay.

It will be seen that the nature of the components used in magnetic amplifiers would be expected to give a long and trouble-free life, and this is found to be the case provided that the rectifiers are suitably chosen to meet the highest possible ambient temperature to be encountered. Fig. 7 shows an example of a 350 W magnetic amplifier.

Transistors. A development which at present has only small-scale application, but which may in the future have much greater use, is that of transistors for machine field power control. Transistors at present available have severe limitations on permissible voltage and temperature and these are the chief restrictions on their use in voltage regulators.

Fig. 4. Magnetic voltage measuring circuits. (a) Characteristic and (b) typical circuit for saturating reactor type. (c) Constant-current reactor construction and output and (d) typical circuit and characteristic



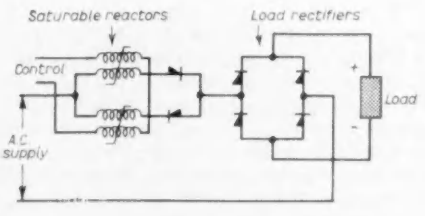


Fig. 5. Two magnetic amplifier circuits

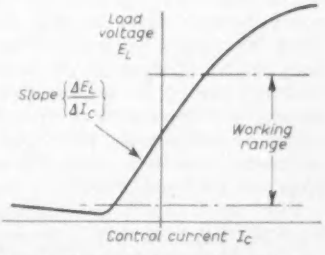


Fig. 6. Magnetic amplifier characteristic

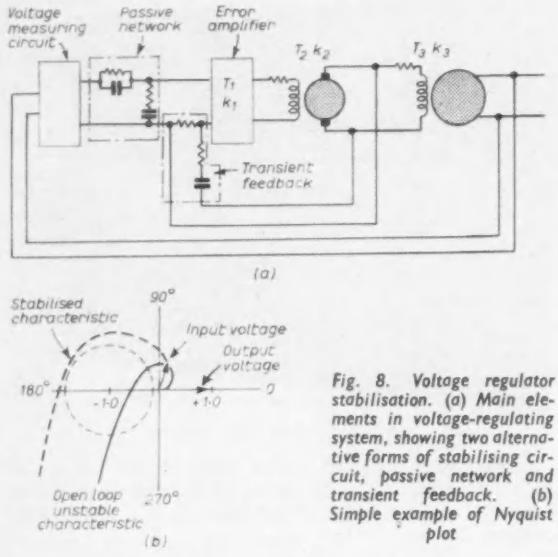


Fig. 8. Voltage regulator stabilisation. (a) Main elements in voltage-regulating system, showing two alternative forms of stabilising circuit, passive network and transient feedback. (b) Simple example of Nyquist plot

Stabilisation or Anti-hunt

The main elements—voltage-measuring circuits and field regulating circuits—which comprise any voltage regulator have been discussed in some detail, and it now remains only to describe some stabilising schemes before proceeding to consider existing types of voltage regulators.

The voltage regulator designer is presented with a number of fixed parameters, these being (a) sensitivity or gain necessary to give the desired voltage regulation, (b) a set of constants for the alternator and exciter. Almost invariably, the above constants lead to a system which is unstable and the generator voltage "hunts." Some form of stabilisation must be provided.

To understand the reason for the instability, reference should be made to Fig. 8(a) which shows the main elements in a voltage-regulating system. It will be seen that the system forms a closed loop consisting of a series of elements each having a time delay T and a gain factor k. For proper operation of the regulation, it is essential that any change in voltage at the generator terminals shall, after passing through the regulator-excitation loop, result in a change in generator excitation in a sense to correct the original disturbance. Unfortunately, the system has a critical frequency of oscillation (hunt) at which the change in generator excitation is phase-shifted by 180°, and instead of being in the direction to correct the initial disturbance actually increases the disturbance and continuous oscillation or "hunting" results.

To prevent this unstable condition, a stabilising circuit is employed, two alternative forms of which are shown in Fig. 8(a). The passive network takes the form of a resistance-capacitance network for electronic voltage regulators, or of an oil, magnetic eddy current, or air damping dash-pot for mechanical regulators. The transient feedback may comprise either a resistance-capacitance network or a special transformer.

The circuit constants required to give stability are calculated by methods such as the inverse Nyquist plot, a simple example of which is shown in Fig. 8(b). The designer selects suitable circuit components to ensure that the unstable characteristic shown as a full line is shifted to a stable form such as the one shown dotted. Additional adjustment is always provided for trimming purposes when the voltage regulator is first commissioned.

Part 2 of this article will discuss the circuitry, construction and performance of some regulators in common use.

(To be concluded)

INTERNATIONAL NUCLEAR COSTS

MORE estimates of the rate at which costs of electric power based on nuclear energy can be expected to reduce are given in a report being submitted by the Board of Governors of the International Atomic Energy Agency to the IAEA General Conference at a regular meeting in Geneva. Sources of cost reductions are said to be savings in fuel cycle charges, due to lower fabrication and re-processing charges; development of better reactor materials; standardisation of components; and lower containment and control cost, arising from more precise knowledge of reactor characteristics.

U.S. Estimate

A recent evaluation by the US Atomic Energy Commission is said to put the break-even point for electricity from a large nuclear reactor and that from a large nuclear power plant "towards the end of the next decade". This assumes coal or oil charges of 55 cents/million B.Th.U. Also assumed are 14% annual capital charge (presumably interest plus depreciation), 80% plant load factor, and no change in uranium and plutonium prices. USAEC estimate of present costs from a 200 MW reactor is 1·1 to 1·4 cents/kWh, say 0·95 to 1·2d/kWh.

The IAEA report is concerned mainly with medium-sized and large reactors. Technical data for smaller power reactors is considered insufficient at present to permit cost estimates of comparable reliability, but the report notes that engineering studies on such reactors are being made in several countries and it contains some cost data and possible extrapolations.

The report represents the first step in what will be a growing activity of the Agency towards wider investigations into the economics and technology of nuclear power. So far, the work has been concerned largely with collecting and evaluating data on various reactor types. Now a USA offer for staff of the Agency to participate in the design, construction and operation of small and medium power reactors has been accepted. A meeting is planned for November at which a panel of experts will prepare a first report on present methods used for costing nuclear power generation.

Apart from these general activities, the Agency has continued its programme of giving help to the countries less advanced in nuclear energy development. It has provided assistance in particular on matters of safety, insurance and general economics. The report canvasses the possibility that there may be instances where a small- or medium-powered reactor might be installed under Agency auspices as a demonstration project, so that a large number of member states might benefit from the experience this would bring.

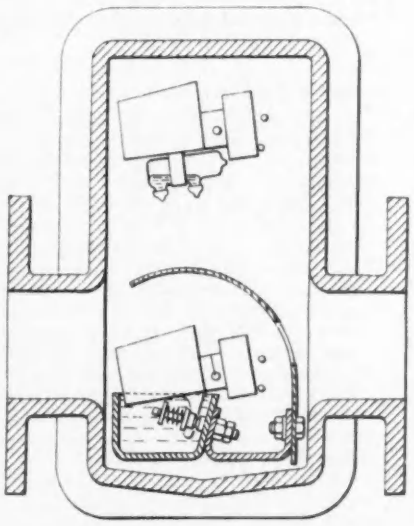
PROGRESS IN PATENTS

SELECTED SPECIFICATIONS

Transformer Protection

Faults in oil-filled transformers and other oil-immersed electrical equipment are sometimes accompanied by the production of gases within the tank which, if trapped within a suitable enclosure, can be used to operate a warning or breaker-tripping device. This is, of course, the basis of Buchholz protective systems.

Patent specification 844,853, in the name of the Englisb Electric Co. of London, describes an extension of the principle to incorporate both warning and tripping



Two-stage warning and tripping protection is provided with this extension to the Buchholz principle

operations as two-stage protection. The device, which is shown in outline, comprises an enclosure in which are two float assemblies, the float in each case being of solid nylon balanced against a counterweight and coupled to a switch such that the weight of the float when not immersed in the oil biases the switch to the "on" position. The upper switch, which may be of the enclosed mercury type, operates to close a warning circuit should an accumulation of gases become trapped within the enclosing dome. If no action is taken and the fault persists with the formation of more gases, the further accumulation lowers the level within the chamber to operate the second float which then trips the breaker to isolate the associated unit in the tank.

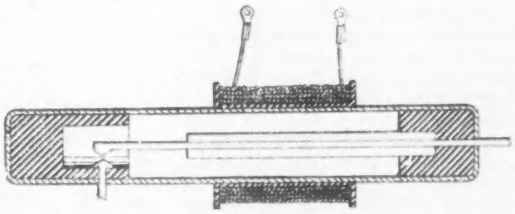
A further protection against severe faults resulting in a heavy surge of oil through the device is provided by an aperture in a baffle plate so arranged that the flow of oil through the hole impinges on the rocker arm to instantly close the tripping contacts regardless of whether or not there is an accumulation of gases in the enclosure. The tripping contacts may be in the form of normally closed butt contacts immersed in the surrounding oil and, to prevent arcing or the possibility of the contacts opening without oil immersion, they are located within an open-topped container within the device.

Conductors for Cooling

The voltage across the capacitor associated with the starting winding in some single phase, capacitor start motors may rise to dangerous values if the winding is switched out of circuit before the motor is up to full speed. This is always a possibility with manual, as distinct from centrifugal switch, starting. One way of limiting the voltage is to make the starting winding of higher resistance, but this means a higher heating loss in the winding. In specification 844,928, attributed to the BTH Co. (now AEI) of London, a means of dissipating the additional heat is by the provision of a second, open-circuited winding within the slots wound coincident with the starting winding. It is claimed that the additional copper in the slots acts as an evenly distributed heat sink absorbing heat from the reduced diameter winding and preventing the formation of hot-spots.

Magnetostrictive Relay

Magnetostrictive relays operate on a principle much akin to the bi-metal thermal relays; that is to say, the armature carrying the movable contact comprises two bonded elements, one of which has a positive and one a negative coefficient of magnetostriction. When the surrounding coil is energised the contraction of one and expansion of the other in the magnetic field causes the armature to bend and close the contacts. The weakness of the design, however, lies in that positive and negative ferromagnetic materials almost invariably have different coefficients of thermal expansion and a change of ambient



A magnetostrictive relay for variable ambient conditions

temperature is just as likely to close the contacts as a magnetic field, or, alternatively, prevent them closing by opposing the magnetostrictive effort.

A novel method of overcoming this objection is described in specification 845,203, attributed to the IBM Corporation of New York, in which the two magnetostrictive elements are cut from a single isometric, or "cubic," crystal and, therefore, have the same coefficient of thermal expansion. However, it has been found that strips cut from different orientations of the same ferromagnetic crystal have opposite magnetostriction coefficients and, by choosing the strips with elongations along different crystallographic directions, it is possible to make a satisfactory relay which is insensitive to changes in ambient temperature.

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OVERSEAS NEWS

from our correspondents abroad

GHANA

Volta Project Tenders

To encourage prospective tenderers to study the site of the projected Volta River schemes in Ghana closely, the Ghanaian Government is prepared to grant financial assistance up to £G2,500 each to a limited number of approved contractors. The grant will be made when the completed tender is submitted, but it will not be made to successful tenderers. The invitation to tender, however, is an open one and will not be restricted only to contractors approved for a grant or financial assistance.

RHODESIA

Cheaper Power for Farmers

Towns in Northern Rhodesia will benefit by a £100,000 power extension scheme from Lusaka to Kafue and Mazabuka. Announcing the extension scheme, the chairman of the Lusaka Electricity Supply Corporation, Mr W. E. Ford, said that power should be available to Kafue in early 1961 with later extensions to Mazabuka. The scheme will bring cheaper power to both towns and will benefit farmers within the areas.

Exploratory work is now under way for the second stage of the Kariba power scheme. At this stage, tests are being made by Cementation Ltd. on the nature of rock formation in which the second power house will be constructed. Preliminary work on this power house, which will be half as large again as the first Kariba station, is expected to be completed by early 1961.

NEW ZEALAND

Copper Plant for New Zealand

Plans to establish a home factory for manufacturing copper sheet, tubes and other components in New Zealand have been approved by the Government. Manufacture will be based on imported raw copper and will enable most of the copper products, more than 4,000 tons annually, which are at present imported, to be made at home. The factory will be owned by ICI (ANZ), of Melbourne, and Yorkshire Imperial Metals, of Leeds. Total capital required for the plant is expected to be £2 million sterling and it is anticipated that 25% of the equity capital will be offered for subscription by the New Zealand public. The managing director of ICI (ANZ), Mr A. G. Rob, said recently that production should begin in about 18 months with full production reached soon after.

Waitaki River Diversion Completed

It is reported that diversion of the Waitaki River has recently been completed a year earlier than scheduled. The river diversion forms part of the £36 million Benmore hydro-electric power scheme and marks the completion of the first stage of the 540 MW station. Work will begin shortly on construction of a 300 ft high earth dam forming the second stage of the project. As a precaution against flooding, coffer dams will be constructed both upstream and downstream of the main dam site.

INDIA

Super-grid Proposals

A proposal is at present under consideration for the formation of a super-grid in the Southern Indian States of Madras, Mysore, Andhra, Pradesh and Kerala. The possibilities of establishing a super-grid with a central control organisation in India will be one of the subjects discussed at the Seventh Irrigation and Power Seminar to be held at Bangalore from 10 to 12 Sept.

Nuclear Choice Economical

Announcing the site for India's first nuclear power station, Mr Nehru said that nuclear power generation for India was more economically favourable than in either Great Britain or the USA because, in India, coal had to be transported over longer distances.

The first nuclear station will be built on the west coast between Ahmedabad and Bombay, at Tarapore. With a capacity of 300 MW, the station will be the largest in Asia and will have two reactors. Two other nuclear power stations are also under consideration, each with a capacity of 150 MW. The station at Tarapore will supply power to Maharashtra and Gujerat and will be controlled by a body consisting of representatives from these two states and the Atomic Energy Commission.

Hopes for the establishment of a nuclear power station in Madras were also expressed recently by Mr V. Ramaiah during a discussion on the electricity boards financial statement for 1960-61 in the Madras assembly. He favoured the establishment of a nuclear power station in Madras by the planning commission and the Government of India during the third Plan period.

No Nuclear Patents

The Indian Government have decided to amend the atomic energy act so that in future, inventions in the field of nuclear energy will not be patentable. The Atomic Energy Commission consider that it would not be in the public interest to allow patents to be taken out for nuclear inventions.

Boiler Breakdown

Delhi suffered one of the worst power failures in recent times when early in August a boiler at Rajghat station failed, cutting off 4 MW of supply. The crisis was aggravated by a previous cut of 5 MW owing to a failure in Nangal generating plant. Representing nearly a 10% cut in Delhi's power consumption, the failures necessitated power cuts in nearly all areas of the city. Failure of the boiler was attributed to poor quality coal which is also affecting the performance of other boilers in the station. To tide them over the emergency, the electricity authorities repaired and commissioned a 1 MW diesel set which had been discarded for some time.

Discussing power breakdowns in Amritsar, the chief engineer of the State Electricity Board said that another 15 MW of plant would be needed during the third Plan period. 5 MW would be required to remove existing restrictions on industry and the remainder to meet new industrial and domestic requirements. Measures are to be taken to improve the electricity supply at a cost of nearly Rs 2 lakhs.

Public Works Project

The heavy electrical project of the Indian Government is to be split between three factories instead of one as originally planned. The first of these has had its planned output raised to Rs 350 million p.a. and is at Bhopal. This project, in collaboration with AEI was originally to have been expanded to a capacity of Rs 500 million yearly. Now it is proposed that two other factories, one in collaboration with Russia and the other with Czechoslovakia will be constructed.

Switchgear production began at the Bhopal factory early in July and work will soon commence on certain transformers. By 1963, the output is expected to rise to Rs 90 million and traction motors and hydraulic generators are

expected to be manufactured. Although it was originally intended to double the size of the Bhopal factory, economic considerations have shown that such a large concentration would be impracticable.

Electricity Output

Generation in Indian power stations for public supply rose to 1,320.9 million kWh during April this year. This figure represents an increase of nearly 13% on the corresponding period during 1959.

Official Opening

The inter-state multi-purpose Chambal project is to be officially inaugurated by Prime Minister Nehru in November. The project is a joint venture of Madliya Pradesh and Rajasthan states, and will generate 210 MW in addition to irrigating 1·4 million acres of land. The first turbine, erected entirely by Indian engineers, recently had its initial trial run.

'Fridge Production

Although production of refrigerators in India only started a few years ago, attempts are now being made to find export markets, chiefly in Pakistan, Kuwait, Kenya and Aden. At the present time production is running at the annual rate of some 7,500.

KOREA

Power Supply Crisis

Reports from Korea suggest that the electricity power supply situation is becoming critical. Earlier this year generation had dropped to the lowest value for three years and, in many areas, supplies to industry and households had to be drastically reduced. Lack of rain affecting hydro-electric generation was a principal cause of the difficulties, but these were aggravated by the failure in June of a 60 MVA transformer at the Susaek power station, near Seoul.

Projects to increase generating capacity are now being given urgent attention and tenders have been submitted by Japanese, German, French, American and British firms. In June, tenders were invited for a 20 MW gas-turbine plan' to be installed at Kwanju in South Cholla province and for emergency use, the Government have purchased a 32 MW power barge from the United States for shipment to Korea this month.

Designs for a 200 MW heat and power station for Pyongyang have been prepared by Soviet engineers. The station is expected to play an important part in solving the heating problem and details are being prepared under the technical aid agreement signed in March last year under which the USSR supplies advice and materials for North Korean industries. Designs are also in hand for adding an electric steel-smelting department to the iron and steel plant in Chongjing.

CANADA

Vast Hydro Project

First step towards the establishment of a new major hydro-electric project in Quebec, on the Manicouagan River, was the announcement a few days ago that the Government has conceded to Quebec Hydro all unharnessed waterfalls on the 250-mile long river. The Manicouagan, one of four major rivers on the north shore of the St. Lawrence, is estimated to have a potential of 6,000,000 h.p. The announcement was made by the Hydraulic Resources Minister, Rene Levesque. He anticipates that work may start before the end of the year. There are four or five unharnessed waterfalls remaining on the Manicouagan, which flows into the St. Lawrence near Baie Comeau. The Manicouagan Power Co., a private firm, has a 292,400 h.p. installation on the river. Mr Levesque stated that forecasts of the province's power needs indicated that Quebec would need power from the new Manicouagan project by 1965. The 840,000 h.p. development now proceeding at Carillon would meet requirements from 1962.

This statement follows an earlier statement by Mr Levesque that the Government would act to stop the granting of any more concessions to private power companies, fulfilling an election promise that the private section of hydro-electric generation would not be allowed to expand. At present, private power companies generate about two-thirds of the provinces requirement which amounts to about 23,000 MW.

Ontario Hydro Report

The annual report of the Ontario Hydro-Electric Commission records an increase in revenue to $213,000,000 and an increase in peak-demand to 5,600 MW more than twice the figure attained ten years ago.

During the year the Commission have brought into service 819 MW of plant and the decision was taken to build a 200 MW nuclear plant at Douglas Point on the east shore of Lake Huron. Layout of the 200 MW CANDU nuclear station at Douglas Point has been so arranged that a further reactor can be added. The decision to install a second reactor will be made after operational experience has been gained on the 20 MW prototype NPD-2 at Rolphton, now under construction. One of the system's greatest undertakings also completed, the conversion of the last of more than a million customers to 60-cycle supply.

Power Generation Up

Power generation by Canadian firms was up by 10.2% in June last to 9,132,588 MWh over the same month of last year. In the first half of the year generation had advanced by 11.7%.

Squaw Rapids Hydro Contract

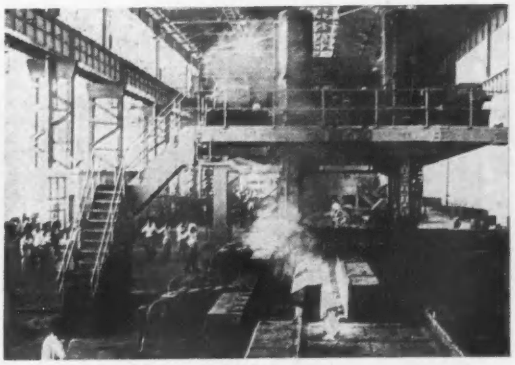
It was recently announced that a contract valued at $10,000,000 had been awarded to Perini (Quebec) Ltd., by the Saskatchewan Power Corporation. The company are to build penstocks and the power station at Squaw Rapids and it is expected that first cement will be poured next spring.

Power System Takeover

Authorisation for the purchase of an electricity distribution system by Hydro-Quebec was approved on 4 Aug. The system is being purchased from Shawinigan Water and Power Co. and brings in a gross annual revenue of $729,000. Hydro-Quebec will pay $1,360,000 for the system which is located partly in Chambly county and partly in La Prairie and supplies electric power to 400 commercial users in addition to private customers.

Wiring Criticised by APEC

At a recent APEC power committee meeting, standards of electrical adequacy were criticised. Mr R. E. Tweeddale, general manager of the New Brunswick Power Commission, urged the establishment of red-seal standards for all new constructions or re-constructions. A study of ways and means to increase electrical adequacy and to impress the public with the dangers of inadequate wiring was expressed at the meeting. It was unanimously agreed that such a study should be begun by the committee.



The first two stages of work are now completed at the Durgapur steelworks. Nearly all the equipment supplied by the 13-firm, British Iscon consortium has now been shipped. The 32-inch intermediate mill, which came into operation earlier this year, is here shown in operation. A 42-inch blooming mill and two of the seven 200-ton arc furnaces are also working

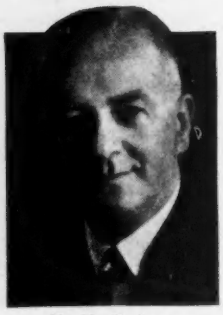
Personalities *in the industry*

Mr E. G. Plucknett

Mr A. Sherry

Mr J. F. Hollway

Mr R. G. Smith



Mr M. G. Jones

Mr C. H. T. Williams and **Mr E. G. Plucknett** have been appointed to the board of Tube Investments. Mr Williams is chairman of Park Gate Iron and Steel Co. and Round Oak Steel Works, and Mr Plucknett is managing director of Simplex Electric Co.; all three are subsidiaries of Tube Investments. Mr Plucknett has had a lengthy association with the electrical industry and after the war became commercial director of Simplex Electric Co. Ltd. In 1951 he also took over responsibilities as managing director of that concern when Mr A. G. E. Briggs was released to serve as Deputy Controller of Supplies (Munitions) Production, Ministry of Supply. He subsequently became director and joint general manager of the company and in 1956 was appointed joint managing director, with particular responsibility for sales and commercial affairs. He subsequently became the sole managing director. Mr Plucknett has also served on various committees, including the BEAMA Domestic Electric Cooker Section, of which he has been chairman twice.

At present deputy station superintendent at Blyth "A" generating station, North Eastern Division, CEGB, **Mr A. Sherry,** M.SC., A.M.I.E.E., A.M.I.MECH.E., has been appointed station superintendent at West Thurrock power station, Eastern Division, as from 1 Sept. (*ESH, page 55).

In the Domestic Equipment Group of the General Electric Co. Ltd. **Mr J. F. Hollway,** A.M.I.E.E., has been appointed commercial manager and **Mr T. Atkins** becomes marketing manager (**Mr D. E. Kidner** remains general sales manager of the group). Mr Hollway joined GEC in 1939 as a student apprentice at the Witton Engineering Works. After the war he completed his apprenticeship and then joined GEC head office staff in 1949 as a sales representative in the Industrial Heating Dept. The following year he was appointed section leader of space heating and in 1953 became assistant manager of the department. In 1957 he was appointed deputy manager of the Domestic Equipment Dept. Mr Atkins, who will also assume responsibility for group publicity, marketing research and sales training, has been associated with the domestic electrical industry for a number of years. The following appointments as area sales managers in the Domestic Equipment Group have also been made: **Mr A. M. Loudon,** Scotland; **Mr R. Dawson,** north west; **Mr R. M. Chamberlain,** north east; **Mr E. R. Walbank,** Yorkshire; **Mr J. Ward,** Midlands; **Mr C. Hopton,** South Wales and the south west; **Mr N. Graham,** Northern Ireland; **Mr C. D. Bayliss,** North London; **Mr H. Dupin,** Central London; and **Mr G. D. Jones-Thomas,** South London.

Mr C. St. L. Brightman, cable regional sales manager, Newcastle branch, AEI Cable Division, was presented with a gold watch recently to mark his 40 years' service with the company. The award was made at the Newcastle branch by **Mr H. D. Parsons,** divisional sales manager. At a luncheon party held on the same day, Mr Brightman was handed an inscribed silver tankard from some of his friends and trade associates in the north east area.

Mr G. H. Gunson has resigned as a director of Venner Ltd. and **Mr Rupert Speir** has been elected in his place.

Mr S. V. Williams has been appointed to the board of Chapman Ultrasonics, a member of Derritron Electronics Group.

Shri V. N. Sarvaiya and **Shri K. C. Nagree,** senior partners of Sarvaiya and Co., of Bombay, now on a business tour of the Middle East and the Continent, are due to arrive in Britain next week. They are primarily interested in visiting factories manufacturing switchgear, fuseboards and porcelains and in general working of the electrical contracting industry and wish to make contact with British firms in those spheres. They will be in London from 8 to 14 Sept. Will interested firms communicate with us?

From Watford Electric and Manufacturing Co. Ltd. we hear of the following changes: **Mr E. Nobbs,** joint managing director and secretary, will in the near future relinquish both appointments for health reasons, but will continue as a part-time executive director. **Mr R. G. Smith,** at present sales and joint managing director, will then become sole managing director. In addition, **Mr M. G. Jones,** formerly deputy sales director, has been appointed sales director, and **Mr T. D. Evans,** a senior technical engineer of many years service, has been appointed London engineer and will shortly be joined by **Mr A. J. Fay,** of sales staff, Watford. Mr Nobbs joined the company as works foreman in 1920 and became chief production engineer in 1938, being elected to the board as works manager in 1946. Mr Smith gained his early training with the company and from 1932 to 1937 was chief estimator (technical sales). There followed eight years as London engineer (technical sales) and in 1946 he was appointed director and deputy sales manager, becoming joint managing director in 1957.

Mr R. H. Thornicroft, superintendent of the Traffic Department at the Leicester Headquarters of AEI Lamp and Lighting Co. Ltd., takes up a new appointment as deputy manager of the Traffic Department at AEI (Rugby) Ltd., today, 1 Sept. The Distribution and Traffic Departments at AEI Lamp and Lighting Co. Ltd. are to be co-ordinated and with effect from the same date **Mr E. G. Thomas** is appointed manager of both these Departments. **Mr R. C. Williams** is appointed superintendent of the Traffic Department.

** Denotes revision to the "Electricity Supply Handbook, 1960."*

Mr Keith Lockyer, B.SC., A.M.I.E.E., A.M.BRIT.I.R.E., has been appointed general manager of Donvin Instruments Ltd. and Dumar Optics Ltd.—members of the R. B. Pullin Group. Mr Lockyer, who has had wide experience in the electrical and electronic industry, had worked in the past with Solartron, Plessey and Philips and was appointed general manager of Victoria Instruments Ltd. when it was taken over by the Pullin Group.

British Insulated Callender's Cables Ltd. announce the appointment of **Mr D. G. Denoon** as public relations manager of the BICC group. With the development and concentration of many Group activities it has become necessary to establish a public relations organisation operating when required for the BICC Group as a whole. Mr Denoon has specialised in public relations work in recent years. He has held previous appointments as publicity manager of Callender's Cables and Construction Co. and joint publicity manager of BICC. In addition, **Mr M. R. Thwaites,** who joined the BICC Publicity Department in 1947, has been appointed deputy public relations manager, and **Mr E. A. Still** is now assistant manager (advertising).

Deputy station superintendent at Coventry power station, East Midlands Division, CEGB, for the past two years, **Mr A. G. Salt,** ASSOCIATE I.E.E., ASSOC.INST.F., has been appointed to a similar post at the Division's North Wilford station. He takes up duties early this month.

Mr P. Broomer has joined Aircraft-Marine Products (Gt. Britain) Ltd. as product manager for programme systems and special products.

Lord Plowden, Sir Geoffrey Crowther, and **Mr H. F. R. Catherwood** have been re-elected directors of the British Aluminium Co. **Mr G. A. Anderson, Mr E. F. O. Gascoigne** and **Mr J. Ritchie** retired by rotation and were also re-elected, while **Mr L. B. Robinson** and **Mr R. G. H. Linzee** retired from the board.

Berry's Electric Ltd. announce that **Mr R. G. Clemetson** has joined their Manchester branch as an outside representative covering the NWEB area (for the last eight years he has been with the GEC), and **Mr T. A. Dunne** has joined the sales organisation based on London covering the SEEB area and South London. (He has been with the GEC, Dublin, for the past 22 years.)

Formerly with Telcon, **Mr B. Keefe** has joined Reliance Cords and Cables Ltd., responsible for sales in the London area south of the river and industrial centres in the Southern Counties.

Mr G. C. Roberts, B.C.L., LL.B., who has been appointed commercial director of Fairey Engineering Ltd., retains his chairmanship of E. and H. P. Smith Ltd., the Birmingham wholesale radio and electrical distributors and engineers. Until recently Mr Roberts was also managing director of Britvic Ltd. and its subsidiaries and a director of Vine Products Ltd. Fairey Engineering Ltd. is one of the member companies of the Fairey Group. In it are vested Fairey's interests in nuclear engineering, guided weapons and hydraulics.

Formerly London sales manager of Hoover Ltd., **Mr E. F. P. Wheller** has been appointed general home sales manager of Kenwood Manufacturing (Woking) Ltd.

The CEGB announces that **Mr H. R. Schofield,** ASSOCIATE I.E.E., has been appointed chief transmission project engineer, and **Mr P. P. Fowler,** A.M.I.C.E., A.M.I.STRUCT.E., is promoted to civil engineer (transmission). (*ESH, page 48.) Since 1949 Mr Schofield has been transmission construction engineer at the Board's h.q. in London, after a year as transmission engineer with the then North Western Division. Prior to 1948 he was with the CEB for 18 years (latterly as area transmission engineer for the NW England area). Mr Fowler joined the then BEA in 1954 as second assistant engineer in the Transmission Department, and he subsequently became senior assistant engineer. Earlier he was with the Ministry of Works.

Certain changes have taken place in the appointment of resident engineers at new constructional sites within the Midlands Project Group area of the CEGB. (*ESH, page 52.) The complete list is as follows:

Aberthaw power station, **Mr J. G. H. Stanley,** A.M.I.E.E.
Drakelow "C" power station, **Mr. E. E. Skingle,** A.M.I.MECH.E., A.M.I.E.E.
Rugeley power station, **Mr G. B. Downham,** A.M.I.E.E.
Staythorpe "B" power station, **Mr G. D. Leydon,** A.M.I.MECH.E.
Uskmouth "B" power station, **Mr M. G. Lodge,** A.M.I.E.E.
Willington "B" power station, **Mr G. G. Thornhill,** A.M.I.E.E., M.I.PLANT.E.

Mr R. M. Jones, Sir Ben L. Barnett and **Mr J. R. Brinkley** have been appointed directors of Telephone Manufacturing Co., with Mr Jones as vice-chairman.

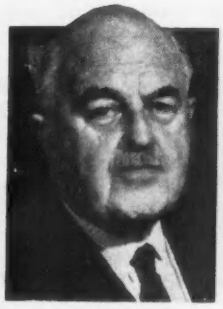
OBITUARY

Mr Laurence J. Kettle, M.INST.C.E.I., M.I.MECH.E., M.I.E.E., who was city electrical engineer of Dublin from 1918 until 1929 when the undertaking was taken over by the Eire Electricity Supply Board, died on 27 Aug., aged 82. Before the war Mr Kettle was a very well-known figure in the electrical world. As chief at Dublin he was responsible for the design and construction of a great deal of extension and development work. He acted on the Water Power Resources of Ireland Sub-committee, 1918-1920, where his previous practical hydro-electric experience in Switzerland proved of great service. Indeed, the formation of this Committee prepared the way for the hydro-electric development of the Shannon, and afterwards the Liffey proposal was largely due to him. Mr Kettle studied at Faraday House and gained practical training and early experience with R. Stephenson and Co., Newcastle upon Tyne, Oerlikon, of Switzerland, and in France. He returned to Dublin in 1912 as deputy city electrical engineer, being promoted to chief in 1918. When the undertaking was taken over by the ESB his services were retained by the Board in an advisory capacity until 1934, and he subsequently served as a member of the Board, and as chairman of the Industrial Research Committee. He was also a foundation member of the World Power Conference.

Mr J. Turner, a former manager of the Transformer Department of Ferranti Ltd., died in Durban early last month. He obtained early experience with Hartley and Co., Stoke-on-Trent, and BTH, Rugby. He left British Westinghouse in Manchester to join Ferranti Ltd. in March, 1920. In the following December he was appointed works manager of the Transformer Department and ten years later, manager. Mr Turner served with the RFC and the RAF. After leaving the service with the rank of Flight Lieutenant, he rejoined Ferranti Ltd., in January, 1946, as resident engineer in London, where he remained until his retirement in May, 1958.

Mr G. L. Drury, A.M.I.E.E., late of LNER, died on 25 Aug.

Mr K. Lockyer


Mr D. G. Denoon

Mr R. G. Clemetson

Mr T. A. Dunne

Mr G. C. Roberts

Readers Views

Correspondents writing under pseudonyms are asked to submit their names and addresses in confidence to the Editor

Standardisation and Exports

MR ROBBINS' article, "Standardisation can Cripple Exports," in your 18 August issue has obviously had to be curtailed through limitations of space. Perhaps I may amplify somewhat his remarks on earth-leakage circuit-breakers by saying that it was mentioned in the CEE committee that when, in certain Scandinavian countries that suffer from a damp climate, a cooker is switched on after several months of disuse, the leakage current can be of the order of one tenth of ampere and sometimes causes the earth-leakage protection to operate. Although unnecessary tripping of the circuit-breaker is objectionable the CEE could not, for obvious reasons, accept a minimum tripping current as large as 100 mA.

The reference to the IEE could also be amplified because the IEE Wiring Regulations specify the use of earth-leakage circuit-breakers to BS 842 without reservation. The minimum tripping current can therefore be between 15 mA and roughly 80 mA. What really matters is the voltage rise of earthed metal and BS 842 aims at limiting this to 40 V.

In the IEE Recommendations for Electrical Installations in Caravans it would seem that account has been taken of the possibility of a higher value of earth resistance in the temporary earth, hence there should logically be a reduction in the tripping current if the voltage rise of earthed metal is to be kept within 40 V.

H. W. Baxter, B.SC.(ENG.), M.I.E.E.
ELECTRICAL RESEARCH ASSOCIATION.

* * *

I WELCOME Mr Baxter's comments on my article, "Standardisation Can Cripple Exports," in that as he also was present at a number of the discussions, he is fully aware of the difficulty the British delegation had in maintaining the level of minimum trip currents of earth-leakage circuit-breakers at what we would consider a reasonable value.

In setting this minimum level, allowance has to be made for two sets of conditions which, to a certain extent, may conflict in their requirements. The primary requirement is that the e.l.c.b. unit shall be responsive to dangerous voltages. Both in this country and on the Continent this is taken to mean that it must detect voltages in excess of about 40 V to earth when it is used in conjunction with a very mediocre earth-electrode: when used in conjunction with a good earth electrode it will detect much lower voltages. The maximum acceptable value of earth electrode resistance is normally quoted as 500 ohms. To put this value in perspective, a 4 ft rod electrode in most areas in this country would have an earth electrode resistance of the order of 100 ohms, or possibly less.

The other requirement is that the unit must not be abnormally sensitive to leakages; and in this connection leakage currents from cooker hot-plates are usually the major offenders. As a result, the operating current of the e.l.c.b. should be in excess of the amount of leakage current normally to be expected from such hot-plates at the instant of switching.

There is, incidentally, a third consideration, which is that the use of operating currents at the higher end of the range implicitly permitted by BS 842 does normally mean that the coil is wound with a heavier gauge wire, and is mechanically better able to withstand lightning surges.

The compromise agreement, therefore, reached at CEE was that the minimum tripping current should not be less than 35 mA—thereby ensuring a major degree of freedom from nuisance tripping.

There is, however, another method of attempting to control nuisance tripping, which is to specify a minimum operating voltage for the unit. This method is used in the Australian and South African Standards, the minimum operating voltages being quoted as 20 V to earth and 19·5 V to earth, respectively, when used in conjunction with a 200 ohm earth electrode.

As a result of all of these differing requirements—only part of which I outlined in my original article—the designer of a trip coil for an e.l.c.b. has to comply with the following specification:

(a) The trip coil must not be mains operated, i.e., the circuit-breaker must not have a relay coil applying mains voltage to the main trip coil for the purpose of tripping the unit (CEE).

(b) The trip coil must operate at 24 V with a 200 ohm earth (most countries); 40 V with a 500 ohm earth (most countries); and 65 V with an 800 ohm earth (Australia and CEE).

(c) The wire size must not be less than 36 s.w.g. (Australia).

(d) The unit must not trip at less than 20 V with a 200 ohm earth (Australia and South Africa).

(e) The operating current must not be more than 80 mA (otherwise it cannot comply with the 40 V, 500 ohm requirement); nor must it be less than 35 mA (CEE).

Surely this impressive list of design requirements is sufficient in itself without now having to take into account the IEE caravan recommendation, with its arbitrarily overriding requirement of a maximum operating current of 40 mA. This requirement clearly conflicts with the internationally agreed figures and automatically places British manufacturers at a disadvantage: they must either ignore the export market or the home market, or—alternatively—attempt to meet all of these design requirements within the unnecessarily restricted operating current range of 35-40 mA.

Mr Baxter has suggested that the IEE recommendations are intended to take care of the possibility of a higher value of earth resistance in the temporary earth, but this point illustrates only too clearly the problem outlined in my original article. In this particular instance it would now seem that British manufacturers are to be seriously hampered in their export drive simply and solely because IEE wish to take care of the theoretical possibility that a caravan dweller might wish to use—as his earth electrode—a 1 ft rod driven into sandy soil!

Once again I can only reiterate the statement made in my original article. It is useless for British manufacturers to go to major lengths to ensure that international standards are written in such a way as to accept units built in accordance with accepted British practice, unless we also ensure that our domestic standards are not unnecessarily restrictive upon design.

J. A. Robbins, B.SC., M.I.E.E., A.M.I.MECH.E.

All-electric Headquarters

ENGLISH ELECTRIC HOUSE COMES INTO USE

ALL-ELECTRIC even to the automatic opening of the plate-glass doors leading to the entrance hall, the new English Electric House was opened last week. With its stone and aluminium façade distinguished by 18 ft high figures symbolising power and speed, this 118 ft high building is the headquarters of the English Electric group, incorporating the pre-existing Marconi House.

All-in-all, the building contains 14 floors from lower basement to roof and is surmounted by a 35 ft high mast on which any type of aerial can be mounted. Up to the fourth floor double-glazing is provided to reduce traffic noise and the building is air-conditioned.

Electrode Boiler

One of the most important engineering features of the building is the electrode boiler installation for space heating. Two Bastian and Allen electrode boilers, each of 1,200 kW rating, will take an 11 kV supply during the night and provide an output temperature of 270°F under a static head of 140 ft. Total storage is 55,000 gallons. Temperature adjustment is obtained by mixing the superheated water with cooler water to supply eight separate distribution circuits for different purposes. Space heating is by panels embedded in the structural ceilings, but in the floors of the entrance hall and the exhibition hall; 450 thermostats throughout the building control the heating system.

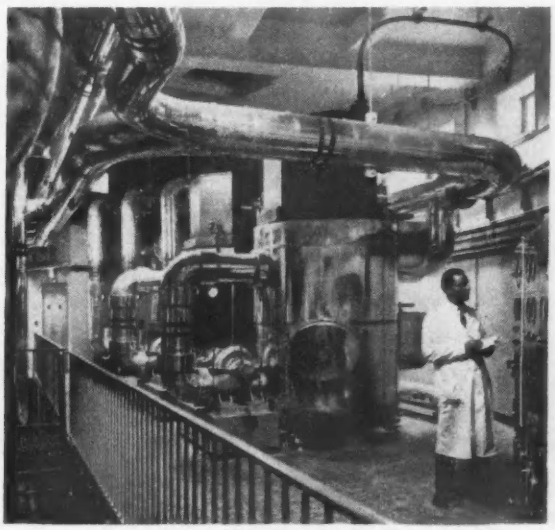
The hot-water system also supplies the air-conditioning plant. The intake air is mechanically and electrostatically filtered, then cooled or warmed, and finally distributed by centrifugal fans of a recently developed pattern which have aerofoil-shaped blades as a contribution to quiet operation. The cooling plant incorporates 130 h.p. of refrigeration capacity.

Four lifts, each of eight-person capacity, serve the new building at a speed of 500 ft/min. They are by Otis and are designed to operate as a group, automatically controlled to suit the changing traffic demands of the day. For instance, in the morning empty lifts return automatically to the ground floor and wait with gates open; at other times they go to pre-determined floors, where they await calls, with gates shut.

Each lift car has an automatic weighing device so that it operates at or near to capacity. When it is shown full in this way, it will not stop in response to landing calls until someone has got out. A separate 300 ft/min fireman's lift is provided, which can normally be used as an extra passenger lift; and there is a 100 ft/min goods lift and a mail lift.

Lighting in all offices is provided by semi-decorative fluorescent lighting fittings fixed close to the ceiling. Cold cathode lighting concealed within a plaster cornice is used for the lift halls. In circulation spaces there is an emergency lighting system, brought into operation automatically on failure of the mains supply.

For distribution purposes, a three-compartment underfloor duct system is provided. Access to this is through floor boxes, in most cases sited in corridors. Each office is provided with a three-compartment wall terminator box, designed in conjunction with the GPO, containing the telephone terminal block, a 13 A socket-outlet and provision for inter-office bell connection.



General view of lower basement plant room

Television, tape and transistors

TRENDS AT THIS YEAR'S RADIO SHOW

ONCE again, the 1960 Radio Show is the largest ever, with more than 156 exhibitors displaying a great variety of radio and television sets, tape recorders and record players. This year they are joined for the first time since the war by 19 piano makers who are displaying in a separate hall.

About one-third of the stands are taken by manufacturers, the remainder being occupied by component suppliers, trade organisations, representatives of the services and, of course, the BBC and ITA.

Television Saturation

Last year, production of television sets at 2,838,000 exceeded by more than a million the combined production of radio and radiograms. However, with a television set in seven homes out of every ten and a coverage for the British Isles of 99%, manufacturers seem this year to have concentrated on variety of appearance, with a number of technical gimmicks, rather than major technical changes. Advent of the wide-angle tube has clearly influenced the tendency for nearly all new sets to use either 17 in. or 21 in. tubes housed in a shallow, slim cabinet. However, on some sets this slim appearance is deceptive, for the bulge at the back containing the tube sometimes approaches the depth of the cabinet itself. A stage has now been reached when the television set is regarded as a major item of furniture and, indeed, one stand shows how rooms can be best arranged to blend with the model selected.

Now that set components can be grouped around the tube structure there is no longer need for a large supporting cabinet. Many makers have left the set as an honest-to-goodness table model, but others have added legs of differing shapes and angles with varying degrees of success. Some are faintly suggestive of one-eyed martians peering vacantly from their stands.

Philco have solved this problem by making one of their six introductions adaptable for wall-mounting. This firm is one of several who have attempted to simplify servicing by extensive use of colour coding and clearly labelled components.

At least two firms are combining printed panels with plug-in construction for the larger components and, although printed circuits are much in evidence, here and there firms have reverted to conventional wiring techniques.

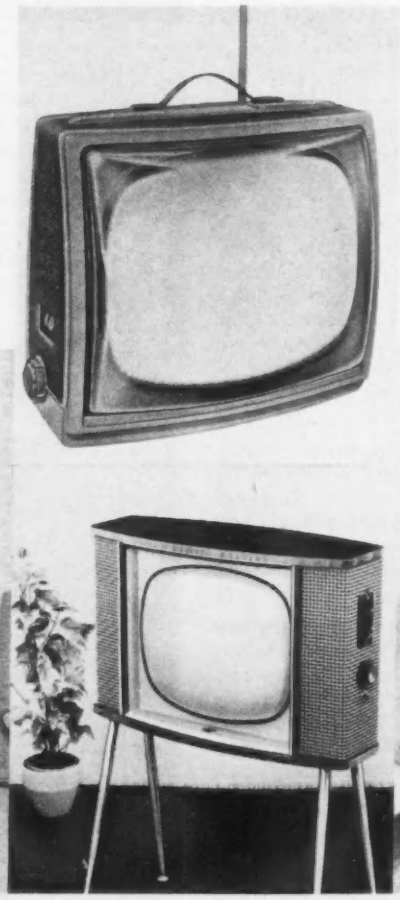
Transistor TV

Ferguson claim to be first in the field with a transistorised television set, although at a price likely to be rather high. The set has a 7 in. screen, weighs 20 lb and is battery operated. Its size is given as only 15 in. by 9¾ in. by 7¼ in. Their range of sets also include models with "selectamatic" fine tuning and "Golden Glide" push-button channel selection.

A new 17 in. model from Decca has the popular turntable feature of earlier models and high quality sound reproduction is ensured by twin speakers. The turntable and "glide-away" doors are also used on one of two new 21 in. sets which incorporate f.m. radio.

The wide angle tube is featured in

The Philco "Codenta" system combines colour coding with a plug-in component system as a maintenance aid. One of the sets in the new range has this wall mounting attachment



Above: A slim 17 in. portable by GEC. Below: Front-facing loudspeakers and pre-set fine tuning are incorporated in this Marconiphone 17 inch consolette

Programme changing from the armchair with this HMV 23 inch model uses an ultrasonic "magic box." The range is 20 ft.

many portable models. GEC for example, have extended their slender, curved styling to a 17 in. portable television with an overall depth of only 12½ in. The set has printed circuits, side-mounted controls and an optional gold-plated telescopic aerial. Gay and attractive finishes of many sets on display this year are exemplified by three models introduced by Marconiphone, which include the VP 168 with grey-coloured Vynair and maroon plastics finish.

Automatic Contrast Control

Several makers, including Sobell, McMichael and Philips, have introduced this year "electronic eye" contrast control which is claimed to ensure automatic adjustment of picture contrast with varying ambient light intensity. As a refinement this follows automatic picture control, a feature improved this year on most manufacturer's sets to cope with viewing in fringe areas.

Automatic brightness and contrast control are not the only introduction this year to make viewing less trouble. Regentone, Peto Scott and a number of other well-known sets have push-button channel selection some with piano key-like switches. Most of these systems eliminate fine tuning, relying on stability and initial setting up for good picture quality.

Remote channel selection without trailing wires has been introduced by HMV with their 23 in. console, Model 1920, one of seven sets with "piano-key" channel selection and radial tuners.

A channel is selected by a box, easily held in one hand, which emits an ultrasonic signal. This signal is picked up by a circuit in the television console and selects the chosen channel. The range of the ultrasonic selector is 20 ft. Sets with the 23 in. tube, intended for hotels and larger homes also appear in a few other makes.

Prices have dropped considerably over the last year. For example, 21 in. table models are available from at least five companies at prices around 69 gn, compared with 75 gn a year ago. 17 in. models are also down in price to about 57 gn, with some makers offering v.h.f. as well for 59 gn. Peto Scott offer an attractive 17 in. portable with v.h.f. radio for 59 gn. Other makers offer v.h.f., twin loudspeakers and "electronic eye" contrast control for 62 gn.

Tape Demand Increase

Tape recording has increased rapidly in popularity over the last few years, especially with teenagers. Many established manufacturers and several new entrants to the field are directing their models at this market.

Although tape recording has still a very long way to go before it matches television or radio for popularity, sales have increased considerably over the last few years and last year exceeded 100,000.

New Entrants

Among manufacturers offering tape recorders for the first time are Ferranti, with a 28 gn model operating at the single speed of 3¾ in./sec. The amplifier provides 2½ W for the 7 in. by 4 in. speaker. Also making their premier appearance with a tape recorder is Dynatron who, in addition to their extensive range of television sets, are showing a three-speed recorder with "pause" control and elliptical speakers, which is priced at 39 gn.

The tendency to make tape playing as easy as using a gramophone is in evidence on several stands where models use tape cassettes are shown. Prices for these models range from 28 gn to as little as 22 gn.

Four-track Models

With more than 30 firms exhibiting tape recorders there is plenty of variety to choose from and, for the more specialist buyer, at least four firms are showing four-track recorders. Four tracks, using the standard ¼ in. tape enables playing time to be increased, for a single 5¾ in. spool, to 18 hours at the slowest speed generally available of 1⅞ in./sec.

But the greatest value of the four-track recorder lies in its possibilities for mixing, transposing and superimposing recorded material and for stereo recording and playback.

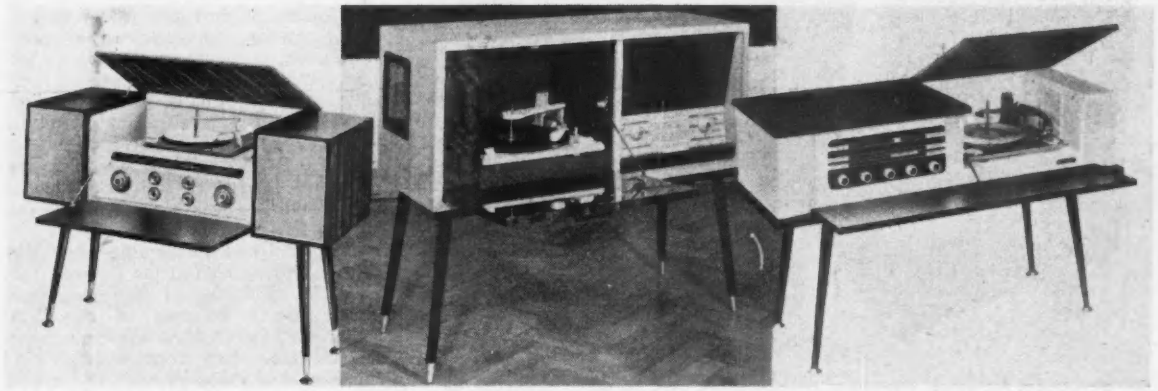
Ekco are showing a six-valve v.h.f. special receiver in a choice of two-tone colours. Below is the Philips "Philette" transistor portable radio

Elizabethan offer two four-track recorders priced at 39 and 55 gn. The first has a single speed of 3¾ in./sec and the second, three speeds with independent controls to allow mixing of two programmes. A three-speed model, the Major, priced at 65 gn is intended for the enthusiast. It has a 3 micron gap head and two speakers giving a response up to 20 kc/s.

Two four-track models claimed to have very good frequency response are also offered in the same price range by Sound Tape Recorders. They are also showing a compact office dictating machine with remote control, which includes back spacing and playback. The "Officemaster" can be fitted with built-in speaker, headphones or "stethosets."

Stereo Tape Decks

Several machines now have full facilities for stereo recording. In addition to



Typifying the range of radiograms at the Radio Show are these three stereo grams. On the left, the GEC a.m./f.m. stereogram is an introduction this year with special bass reflex cabinet. The Philips 598A and, on the right the Philco model 92, also have a.m./f.m. stereophony features

makes mentioned, they include Brenell and Truvox. In the higher price range, Reflectograph have their Model B recorder, which will not make stereo recordings, but will reproduce, with addition of an external amplifier, stereo tape. The price of this model is 105 gn. It can accommodate 8½ in. reels and, again, has four tracks. This company are also showing for the first time their professional Multi-Music tape deck designed for copying tapes.

Both HMV and Walter are showing transistorised tape recorders. The HMV professional recorder is battery-operated intended for "on-the-spot" interviews, while the Walter model can be used either with mains or battery supply and gives high-quality playback with 2½ W output.

Most of the better class instruments include special facilities such as "pause" and mixing. All have safety devices to prevent accidental erasure.

An unusual recorder, shown by Amplion, is intended for use on shipboard. It includes a d.c./a.c. converter enabling its motor to be energised from a ship's d.c. supply.

Record Reproducers

Popularity of the radiogram does not seem to have been affected yet by improvements in tape recorder quality. This year there is a notable increase in the number of transistor battery portables in improved yet less expensive models than last year.

Several of these transistor portables incorporate long and medium wave reception and are in the price range from 22 gn to 37 gn. Perth are showing a transistorised radiogram, with the radio unit detachable, appropriately named "home and away." Their tape recorder also has a bendable and virtually unbreakable plastic cover, a valuable feature for the traveller.

Stereo is, of course, much in evidence both in portable and far from portable sets. In the latter class is the GEC three speaker stereo which gives magnificently realistic reproduction. The centre speaker combines the output from each stereo channel, giving a central image which is claimed to be more accurately defined than is possible with only two loudspeakers. At a price of nearly £500, however, the complete equipment is perhaps a trifle expensive.

Only slightly lower down the cost scale is the stereo Decola, a fine looking piece of furniture with a mere 14 speakers and twin 15 W high fidelity amplifiers.

Stereo Portables

Stereo is also in evidence in a number of the new mains portables, the second speaker often being in a detachable box.

One firm claims to produce stereo effects from a mono record with a special attachment and an extra loudspeaker. There are a few console record reproducers on view, but most of the models are floor-standing machines generally of one-piece stereo design with a.m./f.m. radio. Many of the designs are in wide, contemporary cabinets with speakers at each end. The Philips stereogram selling at 69 gn has two 8 in. double-cone speakers with easy individual adjustment for acoustic balance. It can be used with a tape recorder and for playing back either mono or stereo tapes. Dynatron have two new record reproducers with dual speaker system and autochange priced at 64 gn and 77 gn and their "Oxford" radiogram for stereo, mono, v.h.f./a.m. radio has an output of 7 W per channel and is priced at 119 gn. In the same price range are three stereophonic radiograms by HMV.

Reverberation Circuit

Introduction of a reverberation circuit by Ferguson into their latest stereo radiogram is intended to create a concert hall impression. The reverberation circuit gives reproduction similar to that obtained with an echo box and is effective for certain popular tunes. The reverberation is variable in three degrees and can be switched out if desired.

V.H.F. Transistor Radio

Now that high frequency response transistors are available, manufacturers have quickly applied them to radio. This year sets are available for v.h.f. and f.m. as well as medium and long wave reception. Prices are as yet rather high at about 28 gn, with some of the later models as low as 24 gn, but no doubt prices will fall as techniques become established. Transistor portables are included in nearly every manufacturers' range, some in neat cases easily carried, others in attractive colours to brighten the home. One dual purpose portable is designed as an alternative, to draw its supply from a car battery through a special fitting. Sobell have a 15 gn portable giving two wavebands from a six transistor circuit, incorporating elliptical loudspeaker and built-in ferrite aerial rod.

Two makers at least have pocket portable transistor sets. GEC introduce their 15 gn six transistor model measuring only 6¼ in. by 3⅞ in. by 1½ in. The Ekco pocket set is slightly larger but priced at 13 gn.

New Components

As in previous years many stands are occupied by suppliers to the industry. Bulgin are showing their new range of signal-lamp fittings for panel mounting and a variety of switches. Several manufacturers, including AEI and STC show selections of their transistors, both silicon and germanium, particularly suited for application in the radio industry.

In the range of accessories made by Dubilier are included newly developed products such as the range of tantalum capacitors with very low leakage and long shelf life. Condensers are also shown by Telegraph Condenser Company, although with emphasis on their extended range of sub-miniatures in metal tubes. This firm also show examples of ceramics for the radio industry and applications of printed circuits with the recently introduced "plated-thro" circuits.

One of the largest suppliers to the industry, Mullards, are demonstrating by a display and short comedy film the application of their products. With the home market for television reaching saturation, development of receivers for the continental market is receiving their attention, particularly for 625 line systems with their attendant difficulties resulting from the negative modulated signal and larger voltage mains variations that are experienced overseas.

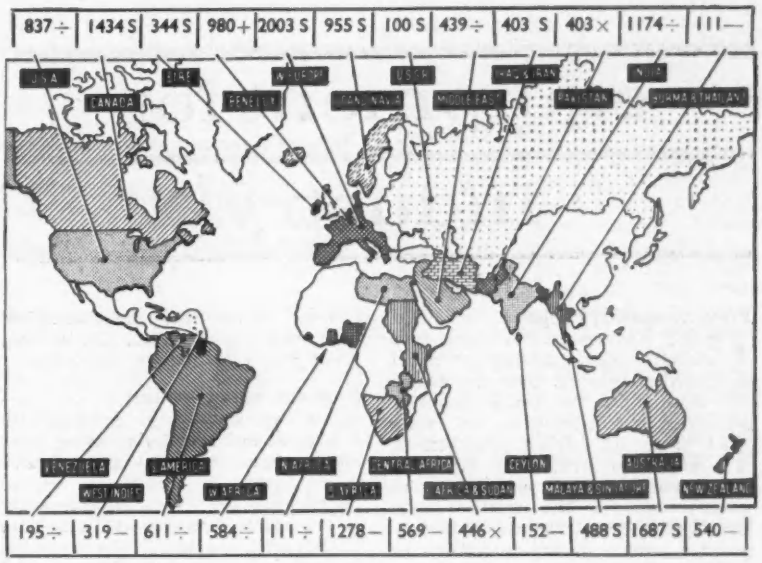
The Elizabethan four-track, three-speed recorder shown with, on the left, Ferranti's first tape recorder and on the right, the Regentone RT20 with tone control

Pye's Private Show

Undoubtedly the main attraction at the Pye exhibition held at the Festival Hall was the application of stereo television to remote handling of dangerous materials. This formed the centre-piece of a display which ranged from a 23 in. television set, through transistor radios and television to variable speed motor drives.

Distribution of Exports in £'000's Sterling

×=over 25% increase
+=10% to 25% increase
S=10%+ to 10%−
−=10% to 25% decrease
÷=over 25% decrease
on previous year's figures.



EXPORTS IMPORTS

July

THE export situation for all types of electrical goods is far from bright, judged by the latest returns from the Customs and Excise. Total value of electrical exports during July, at £20,303,040, was some £200,000 higher than in June, which was the lowest total so far this year. On the heavy plant side, exports of motors increased slightly, but switchgear suffered a reduction. A somewhat brighter picture is seen in the domestic appliance sphere, where washing machines, vacuum cleaners and refrigerators made another step forward, raising the total for appliances by nearly £500,000 compared with the previous month.

Exports of fans, however, dropped sharply, the desk type being principally affected.

The cable industry is struggling to hold on to its hard-won position, exports of paper-insulated cables being up on the June figure. Of the total exports, Australia took the major share, valued at over £1,687,000 which includes £260,000 for generators and motors, £187,000 for radio and electronic gear and £69,000 for cables. Exports to Canada also reached the high figure of over £1,434,000.

On the import side, the total value of £5,047,425, while over £200,000 up on the previous month, is more than £500,000 down on the March record figure, and it will be seen that imports of refrigerators have shrunk considerably.

Description	Exports Value (£)		Imports Value (£)	
	July 1959	July 1960	July 1959	July 1960
Generators				
Diesel up to 200 kW	405,335	323,709		
Diesel over 200 kW	355,304	142,160		
Steam turbine driven	32,178	76,951		
Water and gas turbines	278,607	232,879	109,771	124,200
With i.c. and other prime movers	16,538	28,554		
Generators up to 200 kW	103,267	84,646		
Generators over 200 kW	34,081	80,553		
Generator parts	987,264	842,923		
Motors, f.h.p.	245,478	304,265		
Motors 1-250 h.p.	409,870	387,021	150,205	193,953
Other motors	468,109	353,020		
Motor starters and controllers	300,248	253,700		
Converters and rectifiers	98,347	106,181	72,859	211,692
Transformers	1,018,422	526,815		
Switchgear, to 200A, mv	341,249	354,690	101,501	129,978
Switchgear, other	1,256,244	933,812		
Total, Electrical Plant	*6,250,541*	*5,031,879*	*434,336*	*659,823*
Batteries, primary and parts	517,764	619,060		
Lamps filament, over 28 V	93,555	88,448		
Lamps filament, under 28 V	23,265	21,591		
Fluorescent and other lamps	102,396	104,987		
Radio and electronic gear	3,361,979	3,524,501	1,605,509	1,564,642
Telephone and telegraphic equipment	1,798,162	1,541,813		
Cookers	43,896	48,748		
Toasters	15,945	11,078	117,586	122,941
Other cooking appliances and parts	126,342	97,707		
Space heaters	20,938	18,099		
Water heaters	31,774	19,772		
Electric irons	63,755	74,928		
Other heaters and parts	137,296	113,477		
Vacuum cleaners	119,665	232,439		
Floor polishers	81,602	41,205		
Food mixers	51,166	57,184		
Washing machines, domestic	350,906	441,318		
Dryers		43,425		
Washing machine and dryer parts	82,462	168,988		
Domestic refrigerators and parts	740,510	795,044	965,277	383,558
Other appliances and parts	291,327	329,807		
Total, Domestic Appliances	*2,157,584*	*2,862,219*		
Portable power tools	245,293	241,136		
Arc welding plant	30,339	104,953	42,424	59,345
Resistance welding plant	9,768	54,862		
Electric furnaces	47,582	82,955		
Signalling apparatus	254,771	114,338		
Commercial instruments	170,174	216,387	61,932	47,315
House service meters	136,391	125,002		
Wiring accessories	233,117	186,041		
Fans	91,136	96,083		
Lighting fittings and lanterns	293,347	301,984		
Other lighting equipment	90,329	76,862		
Telephone and telegraph cable	709,681	354,222		
Paper insulated cables	594,819	517,046		
Rubber insulated cables	285,377	212,728		
Thermoplastic insulated cables	247,681	260,443		
Winding and similar wires	104,039	134,519		
Other cables and wires	148,471	150,024		
Total, all cables and wires	*2,090,068*	*1,628,982*		
Accumulators and parts	313,205	284,729		
Insulating materials	208,185	155,669		
Electrical ware	110,175	72,121		
Industrial electronic control gear	115,775	164,664		
Permanent magnets	54,903	69,487		
All other articles	2,829,874	2,901,267	1,477,242	2,257,116
Total	21,749,678	20,303,040	4,642,374	5,047,425

equipment for industry

Pressure-sensitive tapes

THREE pressure-sensitive tapes have recently been introduced for use in the electrical industry. Qualities claimed for these tapes are better insulating properties, non-corrosiveness and resistance to certain solvents. Permacel 10 is a plasticised p.v.c.-coated tape with a non-staining, rubber-base, pressure-sensitive adhesive. The tape is said to be suitable for use over a wide temperature range and has a thickness of 0·0065 in. With this thickness, the breakdown voltage is 9·5 kV. Permacel 10 is available in six colours. A second tape, Permacel 46, is constructed from varnished and sized glass cloth with a white rubber-based, pressure-sensitive heat-curing adhesive. The tape 0·0075 in. thick has a breakdown voltage of 2·75 kV. For general electrical insulation, Permacel 48 is available formed from varnished and sized specially treated unbleached cotton cloth and again spread with a white rubber-based pressure-sensitive heat-curing adhesive. This tape is 0·013 in. thick and has a breakdown of 1·5 kV. All three tapes are available in width from ½ in. to 6 in. *Permacel Tapes Ltd., Slough, Bucks.*

Heating control units

FOR the control of floor-warming, water-heating and light installations, Londex are manufacturing a range of custom-built control panels. A typical panel, which would contain a synchronous motor-driven time switch, a double pole on-off switch, a mercury switch relay and individually fused circuits is illustrated below. All these components are housed in a sheet steel case and an additional relay time switch or a timer may be added. *Londex Ltd., Anerley Wks, 207 Anerley Rd, S.E.20.*

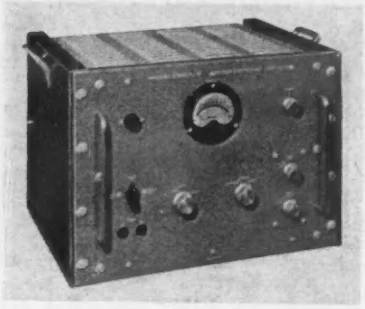
A Londex custom-built heating control unit. Similar units, to customer's requirements, are available for floor-warming control and other time-dependant heating schemes

Precision speed control

FOR applications in scientific research and engineering where high-accuracy speed control with small drift is important, for example, drives for centrifuges and for semi-conductor crystal pullers, Servomex have introduced a controller type MC47. The controller is used in conjunction with a special motor incorporating a high accuracy tachometer generator and which can also be provided with a flywheel to limit speed variations when driving a pulsating load. The control system differs from most motor speed control schemes in utilising a constant current armature supply. Compensation for variations in speed and torque are made by varying the motor field current. The motor develops a torque of 70 oz-in. over a speed range of 0-7,500 r.p.m. Speed drift with constant torque is exceptionally low at ±2 r.p.m. maximum. Application of full rated torque will not change the speed by more than 10 r.p.m. over the entire speed range when the flywheel is used.

An advantage claimed for the controller is that rates of deceleration and acceleration are identical. Use of a constant d.c. armature supply means that torque output is approximately proportional to field current and can be estimated by measuring field voltage.

For testing servo systems, Servomex have also introduced a signal source, Type TWG100. This wave-form generator provides square, sine and ramp waves over the range 0·03 to 30 c/s with continuous adjustment by a six-range switch. Voltage outputs of 10, 20, 30 and 40 volts peak to peak are available with a variable output from 0 to 5 volts. The wave-form generator includes a high-speed relay operating at mains frequency which may be used as a switch to enable two signals to be displayed on a single-beam oscilloscope. The company have also recently issued a leaflet describing their instructional Servo systems for technical colleges and universities. *Servomex Controls Ltd., Crowborough, Sussex.*



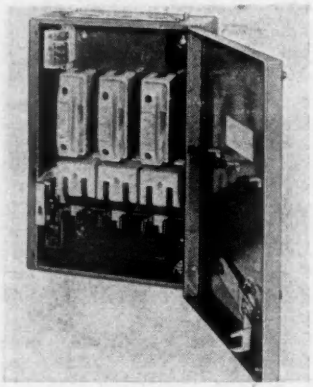
Accurate speed control over a wide speed range is achieved with this Servomex MC47 regulator and a specially designed motor having a 70 oz-in. torque rating

6 V motors

TWO new 6 V motors, intended for record and tape players and similar applications have been announced. They have torques of 12 and 10 gm cm. The motors are available for speeds from 1,500 to 4,000 r.p.m. and a governed version is said to maintain speed within ±2½% over the full-load range. *Limit Engineering Group, 64 Essex Rd, N.1.*

Front-operated switchgear

THE successful introduction earlier this year of the Memrex-Exel range of switches and switchfuses has now been followed by the Exel series of 500 V switchgear. Improved appearance and neater layout on switchboards has been achieved with the Exel series by provision of a front-operated switch handle. The switches and switch fuses are housed in a heavy gauge sheet steel fabricated case, rustproofed and finished in grey stove enamel. The cover is hinged and serves as a mounting for the robust switch operating handle and mechanism. This switchgear has been designed to accommodate either semi-enclosed rewirable or h.r.c. cartridge fuse carriers since, in many industrial areas, the short-circuit fault current level is now reaching values for which only the h.r.c. cartridge is suitable. The new 500 V switchgear and fuse boards comply with the requirements of the relevant British Standards Specifications and IEE regulations. The well-established Memrex-Senior a range of weatherproof switchgear has also been redesigned. The cast-iron switch case and side-operating switch handle are retained, but all units are now fitted with rewirable h.r.c. fuses. *Midland Electric Manufacturing Co. Ltd., Reddings La, Birmingham 11.*



The new Memrex-Exel switchgear incorporates front-operated switch and fuse carriers for either rewirable or h.r.c. fuses

for the electrical trade

Tube price cuts

SUBSTANTIAL reductions in prices of fluorescent tubes, effective from 1 Sept., are announced by manufacturers. The changes affect warm, white, daylight and a few of the de-luxe and colour-matching ranges by amounts ranging from less than 1s up to 3s. For example, 8 ft 125 W daylight, warm white and white lamps are now 16s, that is 1s 6d down; 5 ft 80 W models in the same grades are now 2s 11d cheaper at 12s 4d, whilst the 4 ft 40 W tubes are 11s 5d instead of 13s 9d. Colour matching, natural and de-luxe warm white 4 ft are now 12s 11d, a reduction of 9d. So far, reductions have been announced by Atlas, Ekco, Osram, Mazda, Stella and Philips, and are effective from today (1 Sept.).

Latest tumbler dryer

LATEST addition to English Electric's domestic appliance range is the "Liberator" tumbler dryer specially designed to give best results in handling synthetic as well as natural fabrics. It is controlled by a two-heat switch and an automatic timer to give up to 120 min of drying time and a cooling period. Cycle is briefly as follows: the timer is set, the drum commences to revolve and, simultaneously, a 1,425 r.p.m. fan draws air through the back panel and over the pre-set heater. Warm air passes through the drum which revolves at 55 r.p.m. and out through the top vent. This outlet is shielded by a filter mesh which can be removed for cleaning at a moment's notice. The cycle finished, the timer switches off the machine, but the drum continues to revolve for some minutes to ensure that synthetic fabrics are gently finished in the cooling air.

The two-element heater gives 2,750 W and 2,000 W. Dimensions, 25 in. wide by 23 in. deep by 33¼ in. high. Drum diameter, 23 in. Capacity, 12 lb wet load. Model No. 4602. Price, tax paid. £60 18s. *English Electric Co., Marconi Hse, Strand, W.C.2.*

Italian coffee mill

A COMPACT coffee grinder is now available from the Italian manufacturers Piselli. Available in white, pink or blue plastics, the outer container resembles a beaker about 6 in. high capped by a transparent lid. It stands on small rubber buffers. Rotary blades operating at 24,000 r.p.m. are said to mill all the beans at the same rate, ensuring an even grind whether coarse, medium or fine. The 110 W motor, with push-button control, runs on precision bearings and is guaranteed for one year.

The grinder is supplied in an attractive carton with a leaflet suggesting milling times for various grades of coffee. It sells at £3 15s tax paid and is distributed here by *Insley (London) Ltd., 21 Poland St, W.1.*

Cleaner becomes a polisher

ELECTROLUX have introduced a valuable accessory for use with their cylinder vacuum cleaners. It is a rotary "turbo" head carrying brushes or pads for floor and furniture polishing and operated by the powerful inflow of air. When used on the floor a heavy "shoe" attachment adds weight to the head, but without this it is a handy lightweight furniture polisher which can be used just as easily on the car.

Apart from the shoe, accessories include two sets of brushes, hard and soft, for waxing and polishing and two buffs for finishing, felt for floors and sheepswool for furniture. The turbo-polisher can be attached to Electrolux Models 62, 55 and 65. Price £8 5s 3d tax paid. *Electrolux Ltd., 153 Regent St, W.1.*

Automatic percolator

THE "Swan-Brand" range of electric coffee percolators now includes the "Winchester Automatic." It is in the form of a tall jug, like the previous three models, with an immersion element incorporating the usual safety cut-out device. It has a large two-pint capacity, with a filter unit which gives, say the makers, almost immediate percolation. "Winchester," closely resembling the "Dorchester," but finished in chromium-plated aluminium, sells at £6 4s tax paid. Cat. No. 490. Rating 450 W. *Bulpitt and Sons, Swansea Wks, Birmingham 1.*

The ingenious accessory that turns an Electrolux vacuum cleaner into a rotary polisher. £8 5s 3d

Twin-tube fitting

THE "Princess" 5 ft twin-tube diffuser fitting diverges from the functional styling of the present trend in this field and provides a highly decorative lighting unit. It is fluted in cross-section and made up of 20 sections, alternately transparent and pearl. They slide freely from axial supporting rods for replacement and cleaning. The diffuser is so designed that it allows a certain degree of upward light. This fitting has bi-pin type lampholders and provision is made for chain suspension, close ceiling mounting, etc. Metal parts, including end-caps, are stove enamelled with hammer finish. Price of the "Princess" is £15 list, plus 17s 7d purchase tax. It carries a two-year guarantee. *Luxram Electric Ltd., 72 Gt. Eastern St, E.C.2.*

Frigidaire dryer price

A £5 5s reduction is announced by Frigidaire for their Model A-1000 spin dryer. From now on this machine, which operates on a time interval cut-out device, will sell at £24 3s tax paid. Retailers will be rebated on present stocks. *Frigidaire Division of General Motors, Stag La, Kingsbury, N.W.9.*

Blanket heat control

A NEW fully variable control switch, "Ceetherm," makes multi-heat blankets of ordinary single-heat models providing the user with close-heat adjustment at the touch of a finger. It consists of a double-pole switch mechanism in a narrow case of the through-cord type. Control is by a marked wheel in the side lit with a small neon lamp. Components mounted on a sturdy base are easily accessible by removal of the cover. Wiring up and fuse replacement are thus simply accomplished. BS 2612. List price: £1 9s 6d. *Crater Products, Knaphill, Woking, Surrey.*

Kitchenlight price down

AS from 1 Sept. the price of the "Kitchenlight," a fluorescent tube with ballast-lamp fitting, is reduced by 9s. From now on it will sell at £2 18s 6d complete. "Kitchenlight," it will be recalled, won a Design Centre Award in 1959. *Atlas Lighting Ltd.*

Second Pakamac 'fridge

AS promised, Pakamac are to produce a second refrigerator, a 2·5 cu ft model, to follow up the 4 cu ft which appeared last April. The new model, "Pakamatic 250," is described as retaining most features of the earlier model, which, it will be remembered, is an absorption-type refrigerator with a flat working top. It is still on the production line and no further details are available at present, but full particulars will be issued to the trade during November.

Electric fire lighter

A STURDILY constructed electric fire lighter is available in the "Hockley" range. Claimed to kindle most fuels in five minutes at a cost of ½d, it comprises two elements, with a total 1 kW rating, wound on ceramic formers which are then inserted into outer ceramic sleeves. These in turn are introduced into stainless-steel tubes for final support and protection as they lie in the final open-topped cast-iron container. The lighter is stood on the grate and small pieces of fuel placed around it. When finally removed from the fire, about half an hour later, it can be safely tapped to remove ashes. It has a long metal tube handle partly encased in a wooden sleeve. The "Hockley" electric fire lighter sells at £1 18s, tax paid. *Hockley Electric Co., 56 Gt. Hampton St, Birmingham 18.*

Sax increases

INCREASES of 30% to 35% on all 1958 catalogue prices are announced by Julius Sax and Co. The changes are effective from 1 Sept. *Julius Sax and Co., 24 Commerce Rd, Brentford, Middx.*

Sunhouse newcomers

THE new 303 coal-effect model in Frost's range has a full rating of 3 kW. This load is divided between three independent elements grouped in one reflector mounted above the "coal," which, incidentally, is made from fibreglass and is washable. Casing is square and robust in appearance, with bright metal bars before the coal effect. Its illumination unit, with the usual flicker device, can be left on without heat if required. Model 303: price £13 9s tax paid.

The same manufacturers are distributing a new infra-red domestic heater; a wall-mounting model which is cord operated. It is distinguished by a guard which lies close around the element leaving the reflector accessible for cleaning. Advertising on a broad scale is announced for October. Both fires come under the "Sunhouse" trade mark. *H. Frost and Co. Fieldgate, Walsall, Staffs.*

The new 3 kW "Sunhouse" heater has washable fibreglass coal effect

New tungsten fitting

AN opal glass tungsten lamp ceiling fitting of practical decorative/functional design has been introduced by SLR. The new fitting, SL/1, is intended for schools and general purpose use. It combines the diffusing qualities of satin opal glass with careful design that allows a certain amount of direct illumination. It may be used with BC or ES lampholders. Price £1 7s 9d, plus 5s 4d purchase tax. *SLR Electric, Cranborne Industrial Estate, Cranborne Rd, Potters Bar, Middx.*

Linolite price

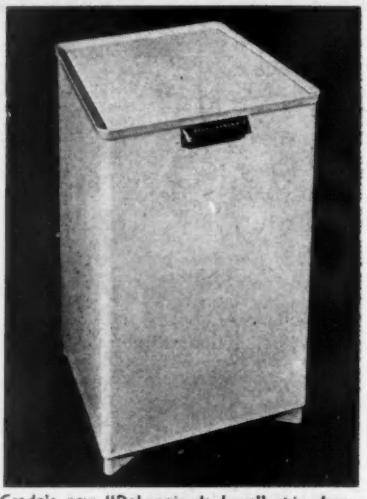
THE "Gaylux" strip light fitting by Linolite Ltd. featured in 11 Aug. issue was illustrated with a caption quoting the price as £13 13s. This should have read £3 13s as printed in the text.

New Creda spin dryer

ON the heels of Creda's £8 reduction in the price of the "Debonair" spin dryer comes news of a new model, "Debonair de Luxe." The new machine constitutes a luxury version of the older model, now to be known as "Popular," and incorporates an automatic pump among its new features as well as special facilities for rinsing. Prices of the two spin dryers are: "Popular," £23 2s; "De Luxe," £30 19s 6d, tax paid in both cases. *Simplex Electric Co., Creda Hse, 26 Binney St, W.1.*

New fluorescent

NEWCOMER to the AEI range of fluorescent lamps is announced this week, the Mazda "Kolor-rite." Claimed to give the equivalent of noon sunlight in colour rendering, it is said to be most suitable for shops selling fabrics and clothing. To begin with it will be available in 5 ft 80 W and 4 ft 40 W bi-pin capped sizes. *AEI Lamp and Lighting, Melton Rd, Leicester.*



Creda's new "Debonair de Luxe" spin dryer. £30 19s 6d

TRADE PUBLICATIONS

CIBA.—20-page brochure, "Introduction to Duxford and to the products of Ciba," from CIBA (ARL), Duxford, Cambridge.

IONLITE.—32-page technical brochure, "Designed Lighting," by Ionlite Ltd., 89 Scrubs La, N.W.10.

GORDON.—Cat. No. 150 on Distance Boiler Water Level Indication and No. 183 on B.th.U. Meter. James Gordon and Co., Dalston Gdns, Stanmore, Middx.

BAILEY.—Five publications: Product Specification sheets, E12-16 on the Electronic Receiver; P99-4, P81-1 and P99-9 on Control Components; and P31-6 on Mini-Line level transmitter. Bailey Meters and Controls, Purley Way, Croydon.

SKATOSKALO.—Illustrated brochure on descaling equipment, by Gilmans Flexible Drives Ltd., Millers Rd, Warwick.

GEC.—Revised Technical Description No. 403 on control board components. General Electric Co., Erith, Kent.

WEST.—11-page illustrated catalogue of Control Gear for Machine Tools. Allen West and Co., Brighton.

MKS.—Leaflet describing services offered by MKS Nucleonics Ltd., 192 Queen's Rd, Watford.

GRUNDIG.—Set of nine technical leaflets on electronic equipment with price list. Wolsey Electronics Ltd., Cray Ave, St. Mary Cray, Orpington, Kent.

EDISWAN.—159-page pocket-book catalogue of Mazda valves, transistors and cathode ray tubes. AEI Ltd., 155 Charing Cross Rd, W.C.2.

EFCO.—16-page brochure on Heat Treatment Furnaces. Publication L33 from Electric Resistance Furnace Co., Netherby, Queen's Rd, Weybridge, Surrey.

EUTECTIC.—Data book on maintenance welding services by Eutectic Welding Alloys Co., North Feltham Trading Estate, Middx.

D.R.—19-page coloured booklet on festoon lighting by D.R. Illuminations, Warren St, Stockport, Cheshire.

MUIRHEAD.—Technical leaflet on Synchro Accessories on mounting instructions. Muirhead and Co., Beckenham, Kent.

PHILIPS.—PL5857 leaflet on Colour 34 double-coated fluorescent lamps. Pamphlet on sodium lamps. Pamphlet on Colour 32 double-coated fluorescent lamps. Pamphlet on mercury lamps and mercury lamps with internal reflectors. Folder describing infra-red heating for pigs, poultry, etc. Leaflet on polyester filled fluorescent lamp ballasts, and control gear. Folder describing gearless fluorescent lighting. Pamphlet on tungsten commercial and display fittings. Philips Electrical Ltd., Lamp and Lighting Group, Century Hse, Shaftesbury Ave, W.C.2.

SWAN-BRAND.—1960-61 Catalogue No. 83 on electrical appliances and ground base aluminium holloware from Bulpitt and Sons, Icknield St, Birmingham 18.

TOP COVER.—The news bulletin from paint manufacturers, Pinchin Johnson and Co., 4 Carlton Gdns, S.W.1. Summer issue.

PYE.—Technical leaflet on the PTC 793/4 Swordfish 11 marine radio telephone from Pye Telecommunications, Marine Sales, Cambridge.

PHILIPS.—15-page illustrated booklet on lighting for photography.

M. AND I.—Brochure, GB860, on glass-based electrical insulation materials. The Micanite and Insulators Co., Blackhorse La, Walthamstow, E.17.

KABI.—Leaflet on terminal blocks from Precision Components (Barnet), Kabi Wks, Cranborne Rd, Potters Bar, Middx.

HOLDAN.—Publication 200, pamphlet entitled "Holdan Materials Handling Plant" from W. C. Holmes and Co., P.O. Box No. B7, Turnbridge, Huddersfield.

News of the Week

WAGE TREND IN SUPPLY

Dropping in the Pay Table

STATEMENTS sometimes made that wage increases in the electricity supply industry spark off rounds of wage increases can hardly apply to the recent NJIC award. Figures of average earnings in various industries, published last week by the Ministry of Labour, show that the supply industry has fallen to eighty-seventh position in order of average weekly earnings. Average weekly earnings of manual workers in manufacturing industry during the last pay week in April, 1960, to which the published figures apply, was £14 16s 4d, and for all industry, £14 2s 1d, (considering only men over 21). For the electricity supply industry, it was £13 1s 9d. The basic hourly wage figures also show the supply industry in a relatively lowly place. Average hourly earnings, again for men of 21 and over, were 65·6d. The corresponding average working week was 47·9 hours, against an overall average of 48.

The position of the electricity supply industry in the order of weekly earnings was once far higher. In 1938 the industry was 24th in average earnings out of a list of 91 industries. Today there are 128 industries listed.

Of course, statistics of this nature need to be interpreted with care, because of the variation from one industry to another of the proportion of skilled and semi-skilled to unskilled manual workers.

Figures for electrical machinery manufacturing industry included in the survey show average earnings of £14 13s 9d, based on an average working week of 47·3 hours.

British plant for Eire

A 40 MW turbo-alternator set will be supplied by C. A. Parsons and Co. Ltd., of Newcastle, for a new peat-burning power station at Shannonbridge, Eire. The contract has been placed by the Eire ESB who are ordering boiler plant from Walther et Cie, of Cologne. Turbo-alternator plant for the extension of another peat station is being supplied by Siemens-Schuckert and the boiler again by Walther et Cie.

Proposed new 275 kV line

PLANS for a 275 kV transmission line to start from the existing grid line near Aylesbury, and to run across Bucks, Berks and Oxon, to a new transforming and switching station at Cowley, are now being formulated by the CEGB. It is also possible that the line may be extended to the west. The Board is soon to have discussions with the local planning authorities on the matter.

Appliance firm calls creditors

ANOTHER direct-sales appliance firm has called a meeting of creditors. This is Elizabethan Dynamatic Ltd., of Bishop's Stortford, who have been offering a combined washing machine and spin dryer at 49 gn cash "direct from the factory." The meeting of creditors is called for 7 Sept. next. The company is an offshoot of the Elizabethan Engineering Co. Ltd.

The Refrigerator Trade's Troubles

ELECTRICAL retailers are clearing existing stocks of refrigerators, probably mostly of imported makes, before placing orders for more British models. That situation is causing serious difficulties for British manufacturers, according to Mr N. F. T. Saunders, managing director of Kelvinator Ltd. who, in a letter to the *Financial Times* last Friday condemned the actions of the Chancellor of the Exchequer in widely varying the hire-purchase restrictions. He points out that the lifting of restrictions in the autumn of 1958 doubled sales of refrigerators last year and this "unhealthy increase" prompted British manufacturers to boost their productive capacity and, what was worse, prompted importers to bring in large numbers of refrigerators from the Continent.

For the first three months of this year sales by manufacturers to retailers and by retailers to the public were about 80% up. British manufacturers committed themselves for material, etc., while importers plunged more heavily than ever.

With h.p. controls, sales fell to about the same level as last year, that is, from an anticipated 180% to 100%, and in later months has even dropped lower, despite price-cutting and other forms of uneconomic trading, he adds. Retailers have cancelled forward orders, cutting back on their intake from British manufacturers. In the case of Kelvinator, sales of refrigerators to the public are twice those to the trade at the present time, Mr Saunders told the "Electrical Times."

He blames successive Chancellors who "seem so completely devoid of any knowledge of industry or any business acumen that it is impossible to get them to appreciate that these peaks and valleys have a disastrous effect on the economy of the appliance industry in this country."

As one effort to avoid such troubles in the future, he suggests that there should be consultation with the industry if the economy seems to call for a greater or smaller production of electrical appliances.

With the latter idea, BEAMA is in agreement, for Mr S. F. Steward, director, subsequently revealed that the conditions cited by Mr Saunders relating to the domestic refrigerator industry are paralleled over almost the whole field of domestic electrical appliances. BEAMA are satisfied that there is a clear need for the Government to be better informed on production, sales and stocks, if h.p. restrictions are necessary as a means of economic control. They are examining the matter with the object of submitting constructive proposals.

TAKEOVER DEALS

—Bastian and Allen

PARKINSON COWAN LTD. have purchased all the Ordinary shares of Bastian and Allen Ltd., one of the pioneers of electrical thermal-storage heating. This acquisition by Parkinson Cowan "is a natural extension of their interests in heating equipment for industrial buildings and processes which now embraces gas, oil and electrical appliances for domestic and industrial applications," they state.

Bastian and Allen's sales have been steadily expanding over recent years, with a sound export business, and in the first six months of this year production has been running at a high level, the company having substantial orders in hand. Chairman of the company, Mr F. D. Campbell Allen, the managing director, Mr S. A. Williams, the sales director, Mr J. C. Edwards, the technical director, Mr E. R. Weech and the Scottish sales director, Mr J. Jamieson, are all remaining in executive control of the business. The company has been associated with electric heating from very early days, originally trading as Bastian Electric Co. Ltd., and installed some of the earliest thermal storage electric water heaters in this country.

—Hobbs Transmission

WESTINGHOUSE Brake and Signal Co. Ltd. have acquired a 50% interest in Hobbs Transmission Ltd.—designers of the "Mecha-Matic" fully automatic transmission system for engines up to 13 litres for vehicles. Arrangements have been made for these transmissions to be produced in the U.K. by the Westinghouse Group.

E.M.I.-M.-R. DEAL NEARLY THROUGH?

ALTHOUGH three of the directors of Morphy-Richards Ltd. (Mr F. P. Bishop, chairman, Mr C. F. Richards, a joint managing director and Mr D. L. T. Oppé) do not recommend acceptance of the terms of Electric and Musical Industries' offer to acquire the share capital, there seems little doubt that the takeover is practically buttoned-up. In their statement issued last Friday, the three dissenting directors still maintain their belief that the long-term interests of the company and stockholders would be best served by an arrangement that preserved the independence of the company while giving it the benefits of practical collaboration with another complementary group.

But EMI have acquired 27% of the issued capital and the possibility of such an arrangement may no longer exist, they point out.

The share exchange offer gives no indication of EMI's future prospects, which are dependent mainly on activities other than the domestic appliance business, and those directors regret that EMI does not find it possible to make a cash offer (33s 6d would be a fair price they suggest). But they realise that the main risk to stockholders as the result of non-acceptance is that they may find themselves in a minority position in a company controlled by EMI, in which event the market for their stock might be very narrow. (On the Market it was understood that EMI have, or are promised, nearly 50% of M-R shares.)

It is revealed that Mr D. W. Morphy, a joint managing director, still retains 5,000 shares after his sell-out to EMI, while Mr W. Roxburgh, managing director of Morphy-Richards (Astral), has 63,199 shares. Both support the proposed merger. Mr Morphy considers the EMI sales outlets at home and overseas would add materially to the prospects of selling the output of the factories, especially of the new large Dundee refrigerator factory due to start operating this winter.

Mr Roxburgh states that last May he was asked by the M-R board to investigate the potential advantages of a close working association with EMI. He reported in June that "such an arrangement would bring considerable advantages to Morphy-Richards, with a substantial increase in turnover in the first year, with much greater increases almost certain to accrue in subsequent years."

Coolkeeragh official opening

THE new Coolkeeragh power station, near Londonderry, is to be officially opened by HRH the Princess Royal on 1 Nov., during her Ulster visit. The station, still under construction for the Electricity Board of Northern Ireland, is oil fired and is expected to be completed by the end of next year when its present capacity of 60 MW will be doubled. Then, the Londonderry Corporation's 18 MW power station will cease to generate, except in emergency, and will become a distribution centre.

Kincardine expansion

THE third 120 MW set at Kincardine generating station of the South of Scotland Electricity Board was synchronised on 24 Aug. last. A 200 MW set will be installed in 1962 and another in 1963, when the total installed capacity of the station will be 760 MW. The station will be formally opened by HM The Queen on 12 Oct.

SWANSEA EXTENSION

CONTRACTS have just been placed by the CEGB for a £500,000 extension to the Swansea North 132 kV substation, near Velindre Steelworks. AEI are to supply outdoor switchgear worth about £250,000, Fuller Electric Ltd. will provide a 45,000 kVA transformer and ancillary equipment costing some £50,000. The extension will provide additional supplies in the northern area of Swansea to meet the large increase in demand by industrial, commercial and domestic consumers.

This is one of two purpose-built vans for the delivery of domestic appliances recently secured by the Cardiff District of the S. Wales Electricity Board. The bodies, on 2-ton extended chassis, are of fibre-glass, translucent in the roof. The ramped access to the body width permits unloading of any appliance without disturbing the remainder

H.V. for C.E.G.B. research

FIVE high-voltage test transformers are included in an order placed with AEI by the CEGB for equipment at the Leatherhead Central Electricity Research Laboratories. Associated regulators, control gear and rectifiers are also included. Two of the transformers are outdoor-type, designed to be used individually or in cascade to give outputs of up to 700 kVA at 1,200 kV for two hours, or 1,000 kVA at 500 kV for two hours. A 1,200 kV wall bushing will take the supply from these transformers into the laboratory. Inside this there will be three 250 kV indoor testing transformers, two of them mobile. Used in conjunction with the selenium rectifiers being supplied, these will make possible d.c. outputs of up to 350 kV.

Praise for N.W.E.B. in the Lake District

HIGH praise for the North Western Electricity Board in its handling of electrification work in the Lake District is given in the annual report and newsletter of the Friends of the Lake District Association. In this it is stated that "electricity supply poses a further problem. But this is being tackled in splendid fashion by the Electricity Board by almost complete use of wholly underground lines. In places where a grass bank bordered the road, as along the shore of Crummock Water, the cable has been buried in the bank and the turf first skimmed off and then carefully replaced, so that little trace of the operation remains to be seen. Similar care was taken in carrying out the Grange to Keswick extension." NWEB—take a bow!

Boiler plant rationalisation in S.A.?

BABCOCK AND WILCOX LTD., of London, are now involved in discussions with Vanderbijl Engineering Corpn., of Pretoria, with a view to closer co-ordination of their manufacturing activities in South Africa. A satisfactory conclusion to the talks is hoped for this month. B and W are associated with Babcock and Wilcox of Africa (Pty), which has works at Vereeniging, near Johannesburg. The Vanderbijl Engineering Corpn., formed in 1945, manufactures boiler plant and heavy industrial equipment.

G.E.C. reorganise *Distribution . . .*

IN order to provide more efficient and economic delivery of goods the Domestic Equipment Group of the General Electric Co. is reorganising its distribution set-up. The Group will now distribute mainly to wholesalers only, although it will continue to deal direct with area electricity boards, multiples and some large retail accounts. This system will enable a reduction to be made in the number of GEC distribution centres stocking domestic equipment products.

. . . and Publicity

FOLLOWING the reorganisation of the company into seven manufacturing groups, the Central Publicity Department of the General Electric Co. has been streamlined. With Mr A. Clarkson as controller of publicity, the department will be responsible for publicity policy and overall public relations, including the initiation and production of company advertising. Individual groups will be responsible for sales and promotional advertising. Exhibition organisation for the GEC and overseas publicity together with the co-ordination of the production and distribution of films will also be handled by the Central Publicity Dept.

In the interests of SAFETY use . . .

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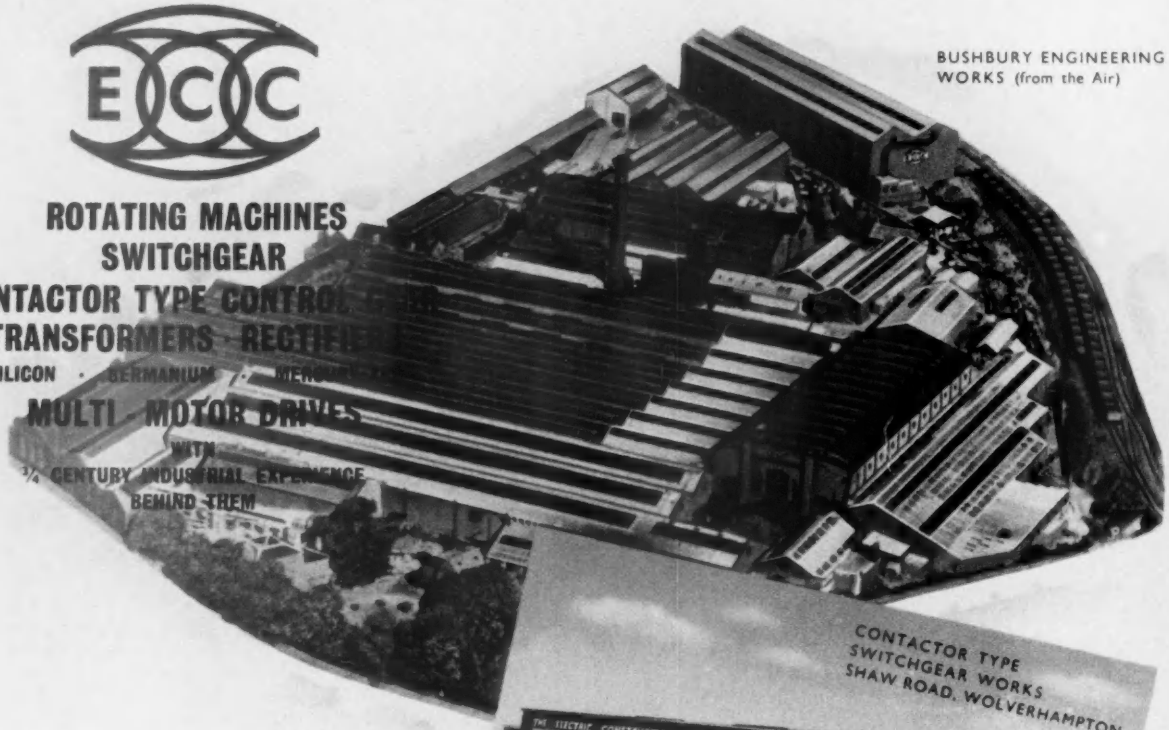
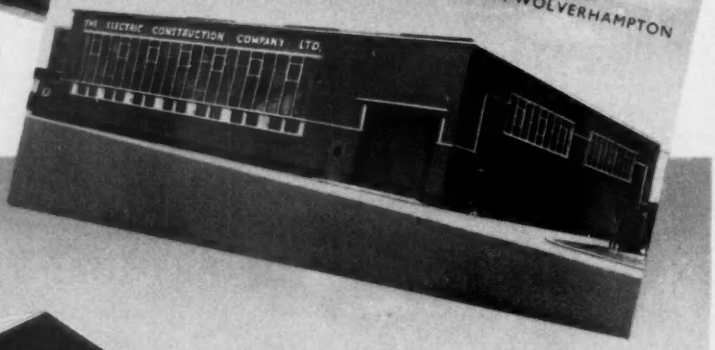


BUSHBURY ENGINEERING WORKS (from the Air)



CONTACTOR TYPE SWITCHGEAR WORKS SHAW ROAD, WOLVERHAMPTON

E C C (Moulded Breakers) Ltd.
Fordhouse Road, Wolverhampton.

THE ELECTRIC CONSTRUCTION COMPANY LTD
WOLVERHAMPTON

OVERSEAS

E.C.C. SOUTH AFRICA (PTY.) LTD., Vereeniging.
E.C.C. (TRANSFORMERS AND CONTROLS) LTD., Lower Hutt, New Zealand.
E.C.C. CANADA LTD., Toronto.
McCOLL ELECTRIC WORKS LTD., Australia
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Coroner Criticises E.L.C.B. Test Instructions

CRITICISM of the test key instructions on an earth-leakage circuit-breaker were made by the Coroner at an inquest at Diss, Norfolk, last week. A woman had been found dead in her bathroom, between an electric washboiler and the bathroom wall. A post-mortem examination revealed no evidence of electric shock, but the washboiler had been found to have a fault from element to frame.

The e.l.c.b. had failed to trip, as this was faulty, due to damage by a voltage surge. The dead woman's husband said he had never been shown how to test the e.l.c.b. There was a notice in small print by the switch reading "when pressed a leakage fault is introduced." The Coroner criticised both the obscurity of the wording and small size of print.

An Eastern EB engineer said it was the present practice of the Board to explain the working of e.l.c.b's along with other electrical equipment installed in houses; and no socket-outlets would now be installed in bathrooms. A verdict of "death due to natural causes" was returned—the deceased was suffering from advanced coronary disease.

Bulbs from Slot Machines

THE idea of buying lamp bulbs from slot machines—recently suggested by a *Sunday Express* reader following a visit to Montreux, Switzerland, where there is such an installation, has been quickly adopted by the London Electricity Board. As a pilot scheme a two-column 24-compartment machine has been installed outside their showroom in Kirkdale, Sydenham. Sub-divisions to each compartment permit a total stock in the machine of 84 lamps of varying sizes and types. It was working on 26 Aug. —five days after the letter in the *Sunday Express*.

More B.E.A.M.A. Appliance Members

GROWING co-operation between domestic appliance manufacturers is reflected in increases in membership of the Domestic Appliance Division of BEAMA. Recent additions approved by the council are: Cannon Industries Ltd. (Heating and Portable Appliances Section); Dishlex (GB) Ltd. (Home Laundry Equipment Section); Thermair Domestic Appliances Ltd. (Home Laundry Equipment and Heating and Portable Appliances Sections); and Thermalay Ltd. (Electric Pads and Blankets Section).

OFFICIAL PUBLICATIONS

BSI annual report, 1959-60. 7s 6d (see page 306).

Bulletin of Special Courses in Higher Technology. L. and H.C. Regional Advisory Council. 3s 6d.

NCB Specification 193/1960: Flexible steel conduit and adaptors for the protection of electric cable. 6d.

B.S. amendment slips: 1975:1957. Primary cells and batteries for intrinsically safe circuits in coal mines. PD 3853; 1981: 1953. Unified machine screws and machine nuts. PD 3864.

Sectionalising the Exhibition

MIXED feelings amongst exhibitors about proposals for sectionalisation of the Electrical Engineers' Exhibition, to group together domestic equipment exhibits and perhaps lighting exhibits, has led the exhibition management to provide a first-floor section for domestic equipment, occupation of which will be voluntary. Exhibitors will be entitled to take space in this section without losing their place in the ballot for stand positions, or their right to a ground-floor stand.

Electrical Handywomen

TO enable housewives to deal safely with minor contingencies in household wiring, the Electrical Association for Women is running, at their London headquarters in October and November, another of a series of evening classes. Besides learning to connect plugs correctly, replace fuses and read meters, "students" will be taught sufficient of the principles involved to judge what should be left for the attention of a qualified electrician. Fee for the three-lesson course is 5s.

Part of a £17 million reconstruction scheme at Cammell Laird's Birkenhead shipyard, this new electric travelling monotower crane was formally handed over by the builders, Butters Brothers & Co., last week. The first of two to be installed, it is driven by eight motors and lifts the maximum rated load of 100 tons at a radius of 122 ft. The travelling tower is 120 ft high, and is supported on 32 rail wheels. [A cabin 126ft above rail level houses the crane driver who keeps in touch with the ground by radio telephone. Total cost of the crane is over £200,000

Wylfa nuclear station — safety pledge

AN assurance that all possible safety measures would be included in the proposed Wylfa (Anglesey) nuclear power station was given to members of the local branch of the National Farmers' Union by representatives of the CEGB recently. Every effort would be made to ensure that the station blended with the general landscape and the effluent discharge into the sea would contain very little radio-active material, it was stated.

For the Board, Mr P. Williamson, a principal assistant engineer, Planning Dept., Bankside Hse, said it was wrong to assume that the station would become obsolete after 20 years' service. "We shall use it as long as it is economical to do so and at that stage we will redevelop it. We can visualise this site being used for a very long period," he added. The Wylfa Head site had been selected in preference to Carmel Head because it was more suitable and cheaper to operate. Two transmission lines would be erected in the Bangor direction to link up with the grid.

Under accident conditions, which were a very remote possibility, the policy of siting stations in areas where there was room to move around to find out what had happened and to take corrective action would ensure that any accident could be properly controlled, he pointed out.

Mr C. F. Weedon, a CEGB administrative officer, stated that a nuclear station would have less impact on the countryside than a coal-burning station. It was also revealed that Anglesey County Council proposed to build an impounding reservoir at Cors y Bol, from which the station would draw 500,000 gallons of fresh water daily.

The rateable value of the station, estimated at £250,000, would considerably alleviate the county rate burden. The Board recommended the formation of a fully representative liaison committee and the establishment of monitoring centres for testing purposes after the station had been completed.

Steelworks Contract for A.E.I.

A CONTRACT totalling £339,000 has been placed with Associated Electrical Industries Ltd. for the supply and installation of six steelworks process line drives. These are for the Spencer Works being built for Richard Thomas and Baldwins Ltd., at Llanwern, Mon, and are to be commissioned by September, 1961.

The AEI contract will also include supply of a.c. auxiliary motors and control gear together with Ward-Leonard closed-loop speed control systems for each of the line drives.

Government influence on nationalised industry wage fixing

BECAUSE nationalised industries are subject to control of Ministers thinking primarily as politicians and members of a Government, employees of such industries may be in a worse position in wage negotiations than those of private industry. This situation has been the subject of extensive trade union discussion, with results summarised in the 1960 annual report of the TUC General Council.

An inquiry into the opinions of unions affected had shown that while direct Ministerial intervention was often valued in wage negotiations in such industries, indirect intervention was disliked. It could take place through investment cuts or restrictive price policies, making it difficult for the industry to improve pay and conditions.

Some unions suggested (as we noted last week) that wages in nationalised industries should be settled by comparison with those in outside private industry. The objection advanced against this technique is that it could lead to unions playing a less enterprising role in the nationalised industries. On the whole the TUC are against this solution to the problem.

From their investigations into this question, the TUC General Council feel that the right of Ministerial interference must be admitted, but that the unions involved in any specific case and the TUC should try to bring into the open the facts of Government intervention as they arise.

Another topic investigated by the General Council has been joint consultation within the electricity supply industry. The report says that several unions have "praised the joint consultation machinery and its operation," though recognising that improvement was necessary by securing greater participation of members at workplace level.

The report gives much space to the TUC's consideration of complaints against the Electrical Trades Union and prints in full the somewhat acrimonious correspondence conducted between the two bodies. This concludes with TUC recognition that in the face of pending legal action by members, the ETU could not proceed with the suggestion for an independent inquiry into its affairs.

Other topics discussed in the report include that of TU members and staff serving on the boards of nationalised industries. Discussions have been held with the Prime Minister with the aim of increasing such membership and attention has been given to problems of safeguarding pension rights, etc., of those accepting such employment. With reference to company law revision, the TUC have quoted electrical contracting as an argument for requiring private companies to file for public inspection their annual accounts. They say that 90% of firms in the contracting industry with whom unions negotiate are exempt from making such returns. This increases the difficulty of wage negotiations.

£280,000 transformer order

THE Engineering Group of the General Electric Co. Ltd. has received an order from the CEGB for two 180 MVA 275/132 kV auto-transformers valued at £280,000. The transformers will be of conventional design with on-load tap changing on the 132 kV winding covering a voltage range of plus or minus 15% in 18 steps.

The two transformers are to be installed in a new substation at Bustleholm in the Midlands Division of the CEGB and will reinforce the supply to Birmingham and the Black Country. They will be fed from the nearby Drakelow "A" and "B" stations which have an installed capacity at present of 480 MW. Aggregate capacity of the "A," "B" and "C" stations will be 2,170 MW.

B.S. — current work

TESTS to determine a satisfactory safety standard for domestic cooking and heating appliances are to be embodied in a new B.S. in the course of preparation. Safety again is of paramount importance with the popular use of portable electric tools and appliances. To this end the BSI are preparing a memorandum revising BS 2754, which deals with double-insulated electrical apparatus. Coincidentally, work is being carried out on a projected standard specifying tracking tests for insulating materials.

In the light-current field, BS 586 on emission type photo-cells is being revised with particular reference to the definition of sensitivity characteristic. Also in preparation is a new standard relating to determination of temperature/resistance characteristics of alloy wires used for precision resistors.

Warmer British homes

RADIANT-CEILING heating was in evidence last week at a small exhibition organised by Specialised Exhibitions Ltd. entitled: "Home Heating and Winter Comfort." Burgess Products Co. Ltd. had on show electrically heated acoustic ceilings, while ESWA Ltd. demonstrated their system of low-temperature resistance foil sandwiched between resin-treated Kraft paper mats, originally developed in Norway.

In competition with solid and oil fuel central heating and appliances, were conventional electrical radiators and convectors. "Thermalay" electrically heated carpet underlay was also exhibited. Thermal-storage systems and appliances were conspicuously absent from the exhibition.

"PLUG-IN CENTRAL HEATING" DRIVE

A NATION-WIDE campaign, costing over £100,000, is being planned by Dimplex Ltd. to promote sales of their electrical heating appliances. To be launched in September, the main selling theme of the campaign will be the competitive cost of the cleaner Dimplex "balanced" electrical heating system compared with an equivalent oil-fuel installation.

Brochures and programme details will be circulated to 15,000 trade customers who will be supported by big advertisements in the national and local Press, together with peak period "spots" on regional TV.

High purity elements

ELEMENTS of importance in semiconductor technique, arsenic, antimony, tellurium and bismuth, are now being produced on a commercial scale in high purity form by Johnson, Matthey and Co. Arsenic is available with impurities as low as 1 p.p.m., antimony at 5 p.p.m., metallic impurities, bismuth 10 p.p.m. and zone-refined tellurium at 1 p.p.m.

President of the G.E. Co, of U.S.A., Mr. R. Paxton, with the vice-president and group executive, Mr J. H. Goss, recently visited the Crawley, Sussex, factory of the associated British concern, Monogram Electric Ltd. Left to right are, Mr Goss; Mr B. R. Sankey, managing director, International General Electric of New York; Mr Paxton; Mr G. C. Crowley, managing director, Monogram Electric; and works manager Mr J. A. Pashler

International standards progress

MAXIMUM temperature rise of oil-immersed transformers was among topics discussed at recent meetings of ISO and IEC technical committees. The temperature rise agreed and accepted by the majority of member countries has been set at a maximum of 65°C and will refer to the principal tapping unless specifically agreed otherwise. Following on this, working committees have been set up to consider recommendations covering inductive reactors and cooling systems.

Representatives from five countries formed a working group to consider the terms employed in drafting a recommendation concerning protective and allied relays. Further progress has also been made in the preparation of Publication 92 which deals with electrical installations in ships, chapters on cables, protection and radio interference having been completed.

Of perhaps wider interest to electrical engineers is the news that recommendations are to be drawn up for international standards for the safety, design, operation and siting of nuclear reactors. These will be based on studies carried out by individual member countries on coolants, shut-down safety devices, casual criticality, irradiation effects and other associated problems.

LANTERNS FOR EGYPT

A SPECIALLY designed four-arm Kuwait lantern is among £5,000 of Siemens Edison Swan street lighting fittings now being shipped to Egypt. The order, placed with Lamps and Lighting Dept., AEI Radio and Electronic Components Division, covers the exterior lighting of the new Aswan hydro-electric station. The four-arm lantern is to go in the forecourt of the station.

Sayings OF THE WEEK

"Now that controls have been put back on again, for Heaven's sake leave them alone. If events should show that they are too severe, then ease them off very gradually." . . . MR N. F. T. SAUNDERS, managing director, Kelvinator Ltd., writing to the *Financial Times*.

"The publication of a British Standard may depend on the outcome of international discussion, so it is important to see that the United Kingdom plays its proper part in this work and helps to keep it moving at a reasonable pace." . . . BSI annual report.

"When conclusions deduced from precise experiments by mathematical theory lead to detailed predictions from which working machines can be designed . . . then indeed one knows that one lives in a universe which is rational, and that one has found the key to one of its rooms." . . . SIR GEORGE THOMSON, in his presidential address to the British Association annual meeting.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, August 30

	£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	238½	−5½
,, (3 months)	238⅝	−4⅝
LEAD, refined pig, 99·97% purity (cash)	71½	−¼
,, (3 months)	71½	−¼
TIN, refined, min. 99·75% purity (settlement)	800	−2
,, (3 months)	800½	−3½
ALUMINIUM, ingots 99·99·5% ...	180	−6
,, wire bars (4×4×54")	193½	—
BRASS Strip 63/37	211½	−3
SILVER (Troy oz)	79½d	—
ZINC, virgin, min. 98% purity (cash)	85½	−½
,, (3 months)...	86½	—
RUBBER, per lb		
No. 1, RSS. spot	28½d	+⅛d
c.i.f. basis, ports, Oct.	28½d	+⅛d
ARMOURING:		
Galv. Steel Wire (0·104 in.) ...	66½	—
Mild Steel Tape (0·04 × 1½ in.)	53*	—
NICKEL (home)	600	—
MERCURY (76 lb flask)	69⅞	—
AMERICAN PRICES:		
Copper, electrolytic (per lb) ...	33c	—
Lead. (New York)	12c	—

* *Tape Price, now an average, includes varnishing*

Linesman did not use gloves

"ACCIDENTAL death" was the verdict recorded at the inquest of a Weston-super-Mare linesman who died after falling 24 ft from a l.v. line pole along the Oldmixon-Hutton road while engaged on maintenance work. The linesman, Mr W. H. Smith, had been working as such for two or three weeks, after two years as a linesman's mate, and was fully experienced, it was stated. Deceased, one of a work party, was sent to make a shackle on a pole and to break another to cut out part of the circuit. But a further switch had to be pulled to cut off all supplies to the area and the deceased knew this, according to Mr D. Hoggart, a charge hand.

The latter intended to do this himself and asked for a ladder to be put up one of the poles. He went back for some tools and then heard a thud and found Smith had fallen into the road. Smith had his belt on, but was not wearing rubber gloves. Replying to a question, Mr Hoggart said that there was no reason to think that, because the ladder was against the pole, the current had been switched off.

Another witness stated that deceased had worn gloves when he broke the shackle and he thought Smith would have taken gloves with him up the pole if he had thought the current was on.

In his summing-up the Coroner said the contact burns on the hands of the deceased indicated that he had clutched, and apparently quite firmly, a live wire. It had been indicated that Smith, after wearing rubber gloves for one part of the operation, had discarded them before going up the pole. The Coroner added: "I cannot think that he would have climbed the pole without gloves if, in fact, he had thought the wire at the top of the pole was live. However, that is possibly not a matter for me to discuss."

E.T.C.T.A. in Scotland

WITH the aim of forming a branch of the Electrical Trades' Commercial Travellers' Association in Scotland, a meeting is being held at Ca'Dore Restaurant, 122 Union St, Glasgow, on 9 Sept. at 6 p.m. The president and national chairman of the Association will be present to welcome all bona fide commercial travellers in the industry. Further information before the meeting may be obtained from Mr A. M. Scales, Atlas Lighting Ltd., 9-15 Waverley St, Glasgow.

Fast coal-shipping plant

TWO new coal-shipping plants of novel design, each capable of automatically unloading coal from railway wagons and transferring it to a ship's hold at a rate of up to 1,350 tons an hour, have been installed by British Transport Docks at Immingham, Lincs. They were designed and constructed by Mitchell Engineering Ltd. Both appliances can handle 55 wagons of coal an hour.

The plants are electrically operated and each consists of a combined wagon haulage and tipping device connected by belt conveyer to a 100 ft loading tower on the quayside. Each plant is designed to be worked by two operators.

News in Brief

Forty-four houses to be built at Victoria St, Harthill, by Lanark County Council, will have electric floor-warming.

The General Electric Co. has awarded 20 university scholarships this year under the scheme established by the company in 1957. Most of this year's scholarship holders will be going up to Cambridge in 1961.

In the article on distribution practice in a.c. ships (p. 193, 11 Aug.) the switchboard shown in Fig. 1 is, of course, an a.c. board and not a d.c. board as incorrectly stated in the caption.

Two 105-ton overhead travelling cranes have been ordered by the CEGB from Herbert Morris Ltd. to help in the construction of Drakelow "C" power station. The cranes will each have a span of 165 ft.

Special courses at colleges in the London area in electrical subjects for graduates and HNC holders are set out in *Bulletin of Special Courses in Higher Technology*, available from the Regional Advisory Council, Tavistock Sq, W.C.1, price 3s 6d.

Company Activities

A NUMBER of industrial share indices went through the 1960 price roof and the *Financial Times* index rose at one time last week to 337·4, only 1·6% below its 4 Jan. "high", and since this most widely regarded index had risen by no less than 9·7 points in three days, "Boom" once more found it was into widespread financial print. Even the latest analysis of the July trade figures (with its £104 million "trade gap") showing that the fall in exports was confined not to any single sector but was common to a broad range of British industry, took only a little steam out of the buying uprush. But why this sudden outburst of buying, anyway? We know that the market is extremely short of stock but it is not enough to accept the facile explanation "more buyers than sellers." My own view is that the recent talks between Mr Macmillan, Government officials, Dr Adenauer and the Italian Premier, before these latter two meet with General de Gaulle next month, supply one of the main clues. It seems pretty clear that the Prime Minister is still attempting to find a way into the European Common Market.

Moreover, there is the coming together of 50 governments at the GATT Conference—accounting for over 80% of world trade—on 1 Sept. to negotiate future international tariff reductions can be viewed as another stimulatory factor for industrial optimism. Appreciative of these straws in the trade winds, not only the UK investor was active in the market last week, but the continentals too came in with massive support.

Company news and views from John Oldham and Son, Pye Ltd., Philips Lamps and Morphy-Richards also gave the electrical market plenty of talking points last week. Oldham, the battery people, now expect to maintain the 17½% dividend on the capital as increased by the proposed one for two free scrip issue thus effectively raising income on the shares by 50% while the likelihood is that profits for 1960-61 will be good.

Pye's chairman, Mr Stanley, at the combined annual meeting, champagne party, exhibition and ballet held in the Royal Festival Hall last week, warned that sales of TV sets were down, but added that there was encouraging progress in the other sides of the business. Up at one time to 19s 4½d his 5s ordinary shares later turned down to 18s 9d, 1s 3d up on the week.

At last the "further statement" from the Morphy-Richards board was forthcoming. M-R's chairman, Mr F. Bishop, together with two other directors, cannot recommend shareholders to accept the EMI bid. The remaining two, Messrs Morphy and Roxburgh, recommend acceptance. Further, with EMI known to hold 27% of the M-R equity and with EMI's 10s Ordinary now around 48s 9d. Mr Bishop advises his shareholders, in a dither whether or not to accept, to "consult your stockbroker or other independent advisers." Very well. Two EMI shares for every three in Morphy-Richard. If you must have the cash, take the 31s 9d the market offers for each of the M-R shares. But if you are interested in higher values later on go for the two EMI shares at 48s 9d each, putting even now a value of 32s 6d on each of the M-R 4s ordinary shares. This year EMI have been as high as 58s 9d: with markets in their present optimistic mood who can tell how soon before this altitude is conquered? —*From our City Correspondent.*

British Relay Wireless and Television Ltd.

With booming conditions the group trading profit for the year to 30 April last jumped to £2,474,606, from the previous figure of £1,427,321. The final dividend is 7%, against 6% forecast on the enlarged capital, making a total of 17%, compared with the equivalent of 13½% last time. The figures include the results of companies acquired during the year, amounting to some £400,000. Depreciation charge is doubled at £1,677,107.

Efco Ltd.

During the first five months of 1960, the monthly value of orders received by the group was about 20% above last year's monthly average, Mr D. F. Campbell, the chairman, reports, and he considers the prospects good for the current year. The expansion of the three principal subsidiaries has been remarkable, he adds, the value of orders received in the last six months was the highest in their history, and that satisfactory trend is being maintained.

Electrical Components (Holdings)

The year just ended finished with a substantial increase in the volume of trade, all branches of the business sharing in this increase, Mr L. S. Seccombe, the chairman, reports. The first three months of the current year have also shown an improvement on the 1959 figures although not on quite the scale of last year, and he is optimistic of the future.

Year to 31 Mar	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1956	301,406	118,047	85	25	8/-	5/11
1957	304,085	116,991	42	12½*	8/3	6/6
1958	319,772	121,625	44	12½	10/10	7/1
1959	337,087	141,191	44	15	14/3	6/11
1960	393,601	168,859	28	11½†	13/9	9/-

* Plus 100% capital bonus.
† Plus 50% capital bonus.

Kango Electric Hammers Ltd.

With sales for the first seven months of 1960 about 15% above those of the last seven months of 1959, the interim dividend is raised 1½% to 7½%. The directors state that since the beginning of this year production has been progressively increased and by the end of July was running at over 30% above the level at the end of 1959.

Oldham and Sons Ltd.

The improved results, in the face of keen competition, are considered gratifying by Mr John Oldham, the chairman, with an increase in volume of all divisions with one exception, mine lighting. Optimistic of the future, the directors hope, in the absence of unforeseen difficulties, to maintain a 17½% dividend on capital as increased by the proposed one-for-two scrip issue.

Parmiter, Hope and Sugden

Although last year's results were disappointing, Mr Eric Sugden, the chairman, is optimistic so far as the present financial year is concerned. He reports that the ordering rate has been increasing with encouraging steadiness since last October when it was about 76%, to over 95% of full output at the present time. He considers that the most acute problems of the immediate future will centre round productive capacity and the acquisition of productive workers and of materials.

Year to 31 Mar.	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1956	90,943	29,426	35	30	3/1-	1/10
1957	105,088	33,683	40	30	3/5	2/7
1958	106,812	31,899	38	30	3/-	2/4
1958	57,508	17,443	19	20	3/6	1/10
1960	41,888	8,570	9	12½	2/10	2/1

G. H. Scholes and Co. Ltd.

After charging taxation at £190,061 *(£146,472)*, the net profit for the twelve months ended 30 June last increased to £202,042, compared with £173,285 last time. A final dividend of 22½% makes the total distribution 27½% on capital increased by a one-for-two scrip issue, compared to the equivalent of 20%.

Thorn Electrical Industries

Plans for the issue of a one-for-one scrip issue of non-voting "A" shares have been vetoed by a group of insurance companies, who defeated the possibility of obtaining the requisite 75% majority. Mr Jules Thorn, chairman, afterwards stated that the board still considered the proposed capitalisation to be fair and equitable—as did many holders of existing "A" shares.

Dividends Declared

Chloride Electrical Storage Co. Interim 5% (*same*).

International Combustion (Holdings). Interim 10% (*same*), but Sir James Reid Young, chairman, warns that for the next two or three years a decline in trading profits must be expected. It is hoped, however, to pay a total dividend of 30%, as before.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

2 Sept.—Dublin C.B. Supply of 200 street lighting lanterns.—See 11 Aug. issue.

2 Sept.—Maidenhead B.C. Erection of 26 15 ft and two 25 ft reinforced concrete columns and fixing fluorescent lanterns/gear and all incidental works.—See 18 Aug. issue.

2 Sept.—Rothwell U.D.C. Provision and erection of 73 140 W sodium units with concrete columns along Leeds-Exeter Trunk Road, A61.—See 11 Aug. issue.

2 Sept.—Stockport T.C. Electrical installation in secondary technical school for boys, Pendlebury Hall, Lancashire Hill.—See 25 Aug. issue.

3 Sept.—Cambridge C.C. Supply of (Item d) lamps.—See 14 July issue.

3 Sept.—Chiddingley. Supply and installation of Thermodare Infra-Red electrical heating (18 kW) at Village Hall. Rev G. Summergood, Chiddingley Vicarage, Lewes.

3 Sept.—Coatbridge. Electrical work at Coathill Hospital. Group Secretary to the Board of Management, Hairmyres Hospital, East Kilbride.

3 Sept.—Irlam U.D.C. Supply and erection of three pumps, any two of which should deal with 350 cu ft per min at 36 ft head of unscreened sewage.—See 11 Aug. issue.

5 Sept.—Manchester C.C. Supply and erection of lighting equipment/auxiliary services for primary sludge digestion plant.—Advertised 4 Aug. issue.

6 Sept.—Dartford B.C. Supply and erection of 91 Group "A" 400 W MBF/U lamps/lanterns on 25 ft reinforced concrete columns for town centre approach roads.—See 11 Aug. issue.

6 Sept.—Lisburn U.D.C. Supply and erection of fluorescent street lighting equipment for improved lighting to Group "B" or intermediate standards.—See 11 Aug. issue.

6 Sept.—Manchester C.C. Supply of street lighting equipment for year from 1 Jan., 1961, comprising: cable, concrete and columns, flashing beacon globes, road sign fluorescent fittings, globes, lanterns, time switches and traffic bollards.—Advertised 18 Aug. issue.

7 Sept.—Birmingham T.C. Alterations and additions, on a firm-price basis, to electrical installation, Highbury Hall, Queensbridge Rd.—See 25 Aug. issue.

7 Sept.—Cheadle and Gatley U.D.C. Supply and erection of 39 Group "A" pre-stressed spun concrete columns with 140 W sodium lamps/lanterns along Manchester Rd.—See 11 Aug. issue.

8 Sept.—Guildford B.C. Supply, erection, cabling and bringing into service of 117 Class "A" lighting along A3100, A246 and A321.—Advertised 11 Aug. issue.

9 Sept.—Castlereagh R.D.C. Electrical installations at 177 houses, 24 flats, Carrowreagh; 50 houses, Gilnahirk Rd; and 21 flats, Grand Prix Pk. A. D. Nicol, Clerk of the Council, 368 Cregagh Rd, Belfast 8. Deposit £3.

8 Sept.—Staines U.D.C. Provision and installation of 215 Class "B" tubular steel columns, lanterns and gear, also dismantling, resiting or adjustment to 252 c.i. columns.—See 25 Aug. issue.

9 Sept.—Glasgow T.C. Supply of 5,000 bracket fittings for lighting stairs.—See 18 Aug. issue.

9 Sept.—Luton B.C. Electrical installation in Challney CSM School extension.—See 18 Aug. issue.

9 Sept.—Worksop B.C. (1) Supply of lanterns, lamps and auxiliary equipment; (2) removal of existing units, supply of new columns, wiring and fitting of equipment; (3) alternatively, whole of work for 100 140 W sodium units on 25 ft columns.—Advertised 18 Aug. issue.

9 Sept.—Wrexham B.C. Supply and erection of Scheme 4 Groups "A" and "B" columns, brackets, lanterns and lamps.—Advertised 18 Aug. issue.

10 Sept.—Rushden U.D.C. Erection of approx. 110 concrete and cast-iron lighting columns and removal of approx. 44 cast-iron gas columns. Engineer and Surveyor, Council Bldgs.

10 Sept.—Waterford C.C. Supply of two 20 g.p.m. centrifugal pumps and motors for Kill and Bonmahon Water Supply Scheme.—See 28 July issue.

10 Sept.—Willenhall U.D.C. Erection of 92 Stanton 9A concrete columns and provision/fixing of 80 W mercury lanterns/lamps with necessary wiring.—See 4 Aug. issue.

10 Sept.—Youghal U.D.C. Duplicate pumps with 190 g.p.m. combined capacity and another pair for 1,410 g.p.m. at a maximum static lift of 53 ft.—See 18 Aug. issue.

12 Sept.—Haltemprice U.D.C. Supply, erection and rendering operative sodium lighting using specified lanterns, gear and 25 ft steel columns (a) Kingston Rd, 110 installations; and (b) Hull Rd and Wilson St, 62 installations. Engineer and Surveyor, Anlaby Hse, Anlaby, E. Yorkshire. Deposit £1 each contract.

12 Sept.—Herefordshire Hospital Management Committee. Renewal of electrical installations Ross Hospital, Gloucester Rd, Ross-on-Wye.—See 25 Aug. issue.

12 Sept.—Kilbride. Electrical work, Presbyterian Church.—See 25 Aug. issue.

12 Sept.—Kirkby U.D.C. Supply of 120 Group "A" totally enclosed 140 W sodium lamps and control gear and erection and wiring of same on concrete columns. Engineer and Surveyor, Kirkby Hall, Hall La, Kirkby. Deposit £2.

12 Sept.—Manchester C.C. Electrical installation in Withington Library.—See 25 Aug. issue.

12 Sept.—Pontypridd U.D.C. Supply, erection, wiring and testing, on firm-price basis, of 32 steel columns complete with Group "A" mercury lighting and 32 similar lighting units with brackets for use on existing columns/buildings for Town Centre and Rhondda Rd, A4058, lighting.—See 25 Aug. issue.

13 Sept.—Armagh C.C. Electrical installations, Collone County Primary School. G. D. Taylor, architect, 27a English St. Deposit £5.

13 Sept.—Londonderry R.D.C. Electrical installations in 18 dwellings, Altinure, and 16 dwellings, Claudy Brae.—See 11 Aug. issue.

14 Sept.—Galston T.C. Electrical work on a "principal contractor" basis for 45 Glyn Rd site houses. Town Clerk's office, Galston.

15 Sept.—Edinburgh. Electric passenger and bed lift, Muirhouse Old People's Home. Town Clerk.

15 Sept.—Portadown. Electrical installation and lift, old people's home, Guildford Rd. See 25 Aug. issue.

16 Sept.—Birmingham T.C. Electrical installations on fixed-price basis for the Children's Committee at Field House Nursery, Clent. Sir Herbert J. Manzoni, City Engineer and Surveyor, Civic Centre. Deposit £2 2s.

16 Sept.—Cheshunt U.D.C. Dismantling existing gas and electric street lights and supply and erection of 62 25 ft mounting height lighting columns and 147 15 ft mounting height lighting columns, and fixing of 140 W and 60 W sodium discharge lanterns and control gear and supply of same. Engineer and Surveyor, Manor Hse, Cheshunt. Deposit £2.

16 Sept.—Cheshunt U.D.C. Provision and erection of Group "A" lighting on planned Turners Hill/College Rd traffic roundabout. Engineer and Surveyor, Manor Hse. Deposit £2.

16 Sept.—Lisnaskea. Electrical installation in fire station.—See 25 Aug. issue.

19 Sept.—Burnham-on-Sea U.D.C. Supply and erection of 22 sodium lanterns, lamps and electrical gear and supply and erection of 22 concrete street lighting columns together with fixing and wiring of lanterns and electrical gear on B3139 and B3140. G. Harvey Mayhew, Engineer and Surveyor, Manor Hse. Deposit £2 2s.

19 Sept.—Huddersfield B.C. Supply of 40 illuminated bollards with "Keep Left" signs and 17 illuminated bollards with plain panel. All illumination by fluorescent tubes. Engineer and Surveyor: A. L. Percy, High St Bldgs.

19 Sept.—Orkney C.C. Electrical installations at new primary school, Papdale, Kirkwall. County Architect's Dept., Mounthoolie La, Kirkwall.

19 Sept.—Rawtenstall B.C. Electrical work in erection of new mortuary, Rawtenstall Cemetery, Burnley Rd.—See 25 Aug. issue.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 109 queries answered this week

"Duco" appliances — suppliers of? S.E.E.B.—Brown Bros. Ltd., 22 Gt. Eastern St, E.C.2.

"Cleanmaster" vacuum cleaners—makers of? E.M.E.B.—Cleanmaster Ltd., 1 Maddox St, W.1.

"Niphan" plugs—makers of? T.E.—Simmonds and Stokes (Niphan) Ltd., Victoria Hse, Southampton Row, W.C.1.

"APK" cable clips—suppliers of? S.E.—Dahl Bros. Ltd., 19 Morley St, S.E.1.

"Crossland" lighting reflectors—makers of? E.E.B.—R. and A. G. Crossland Ltd., Cartbridge La, Walsall, Staffs.

"M.E.P." toasters—makers of? W.H.P.—Mayfair Engrs. and Platers Ltd., Kenwood Wks, Old Woking, Surrey.

"Stringolite" lighting fittings—makers of? B.E.—Falk, Stadelmann and Co. Ltd., 91 Farringdon Rd, E.C.1.

"Auto-Perc" percolators—address for? S.E.B.—Elga Products Ltd., Lane End, Bucks.

"Turnright" switches—makers of? S.L.—Turnright Controls Ltd., West Hill, Hoddesdon, Herts.

19 Sept.—Sunderland B.C. Electrical installation to extensions and alterations to Railway Row Clearing Depot.—See 25 Aug. issue.

20 Sept.—Willenhall U.D.C. Electrical rewiring of Town Yard at rear of Town Hall. Engineer and Surveyor, Town Hall.—Advertised in this issue.

24 Sept.—Laois C.C. (a) Supply and installation of built-in cold room; (b) delivery and supply of steam and electric cooking equipment; and (c) rewiring electric lighting and service socket installation at County Hospital. Consulting Engineers: J. V. Tierney and Co., 15 Duke St, Dublin. Deposit £3 3s each.

26 Sept.—Orpington U.D.C. Supply of Group "B" concrete street lighting columns and brackets. Clerk of the Council, Council Offices, Crofton Rd. Deposit £2.

26 Sept.—Wem R.D.C. Installation of electricity at six council houses, in Ash Whitchurch. Surveyor: C. H. Jeffery, Council Offices, Wem, Salop.

7 Oct.—Southport B.C. Electrical installation at Floral Hall. Borough Architect, 99-105 Lord St. Deposit £2 2s.

No date stated—Durham C.C. Electrical installation at E. F. Peile Convalescent Home, Shotley Bridge, Swalwell Fire Station and Durham Fire Station. County Architect: G. R. Clayton, South St, Durham.

No date stated—Metropolitan Water Board. Applications invited for inclusion in list of tenderers for supply and services as follows: accumulators, motors, alternators, H.T. and L.T. switch and control gear, transformers, rectifiers and accessories. Electrical installation work and cable laying. Clerk of the Board, Offices of the Board, New River Rd, Rosebery Ave, E.C.1.—Advertised in this issue.

No date stated—Redcar B.C. Installation of telephone intercommunication between warden's house and 82 old people's bungalows, Severn Rd. Plans by Borough Engineer, Ridley Hse.

No date stated—Whitby U.D.C. Supply and erection of 117 Group "A" steel octagonal columns, five wall brackets, seven Group "B" steel columns with 250 W colour-corrected mercury and 80 W mercury fluorescent lamps/lanterns/control gear.—See 4 Aug. issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

5 Sept.—India. 95,200 house service meters, a.c. single-phase. Chief Engineer (South), Store Purchase Section, The Mall, Patiala. B.o.T. (ESB/21459/60).

5 Sept.—Pakistan. 25 drilling machines and 16 portable drilling machines. Director of Stores, Water and Power Development Authority (Power Wing), Lahore. B.o.T. (ESB/21379/60).*

7 Sept.—India. Four items iron clad fuse splitter boards. Purchase Officer, Sindri Fertilisers and Chemicals Ltd., Sindri. B.o.T. (ESB/21385/60).*

8 Sept.—India. 42,300 yd of 11 kV p.i.l.c.s.t.a. cable. Chief Engineer (South), Punjab State Electricity Board, Store Purchase Section, The Mall, Patiala. B.o.T. (ESB/21453/60).*

8 Sept.—India. 76 switch fuse boards, six-way, watertight with six 15 A, 250 V switches. Purchase Officer, Sindri Fertilisers and Chemicals Ltd., Sindri. B.o.T. (ESB/21384/60).*

9 Sept.—Formosa. One 8,000 kVA transformer. Central Trust of China, Purchasing Dept., 68 Yen Ping Nan Rd, Taipei, Taiwan (Formosa). B.o.T. (ESB/21665/60).

13 Sept.—New Zealand. Six metal clad, 27-panel, duplicate busbar switchboards. Town Clerk, P.O. Box 2199, Wellington. B.o.T. (ESB/20169/60).*

14 Sept.—Canada. Two items step-down transformers, 5,625/7,500 kVA, 60 cycles, 3-phase, 2 winding. Oil immersed. The Chairman, Committee on Utilities and Personnel, c/o City Clerk, City Hall, Winnipeg 2. B.o.T. (ESB/21559/60).

15 Sept. — India. 40,900 yd 600 V p.i.l.c.d.s.t.a. 4-core cable. Chief Engineer (South), Punjab State Electricity Board, Store Purchase Section, The Mall, Patiala. B.o.T. (ESB/21454/60).*

16 Sept.—Rhodesia. Supplies of various lamps, 220/230 V b.c., 200 W s.e.s., 500 and 300 W g.e.s. Secretary, Federal Tender Board, P.O. Box 8075, Causeway, Salisbury. Tender No. GCS141.

17 Sept.—Jordan. Two 5,000 kVA and three 3,000 kVA indoor transformers, 33/6·6 kV, for Transjordan Electric Power Co. Details from Kennedy and Donkin, Alliance Hse, 12 Caxton St, S.W.1.

19 Sept.—Australia. (1) 106 s.-ph. capacitor voltage transformers for use on 132 kV system. (2) 75 s.-ph. capacitor voltage transformers for use on 330 kV system. Commercial Manager and Secretary, E.C. of N.S.W., Box 5257, G.P.O., Sydney. B.O.T. (ESB/20723 and 4/60).*

19 Sept.—India. Five items of station type lightning arresters. Superintending Engineer, Technical (Electrical), Madras State Electricity Board, 157 Mount Rd, Madras 2. B.o.T. (ESB/21025/60).*

19 Sept.—Libya. Four 1 MVA transformers for Tripoli power project. President, Central Tenders Committee, Ministry of Finance, Tripoli. B.o.T. (ESB/20143/60).*

19 Sept.—Thailand. 170,000 lb all-aluminium bare conductor. Commercial Dept., Metropolitan Electricity Authority, 121 Chakraphet Rd, Bangkok. B.o.T. (ESB/20313/60).*

20 Sept.—Formosa. One d.c. generator armature for Westinghouse turbo-generator exciter. 18 kW, 125 V. Central Trust of China, Purchasing Dept., 68 Yen Ping Nan Rd, Taipei, Taiwan. B.o.T. (ESB/21679/60/I.C.A.).

20 Sept.—Pakistan. Supply, erection and commissioning of 44·8 miles of 66 kV transmission lines. W. Pakistan Water and Power Development Authority, Lahore.

20 Sept.—Thailand. 4,000 7½ in. dia. 5¾ in. long suspension type insulators, 15,000 pin type 23 kV insulators and 4,000 l.v. pin type insulators. Metropolitan Electricity Authority. B.o.T. (ESB/20314/60).*

21 Sept.—Pakistan. 2 million ft 3/·029 single core wire; 887,500 ft 3/·036 to 37/·083 v.i.r. cable; 50,000 ft twin 3/·20 weatherproof wire. Dept. of Supply and Development, Frere Rd, Karachi. B.o.T. (ESB/20320/60/ICA).*

21 Sept.—Spain. Five items: electrical equipment, high voltage testing, relays, breaker pieces and high voltage circuit-breakers. Laboratoria Electrotechnico, S.A. Plaze Dr. Letamendi 5 y 7 Barcelona. B.o.T. (ESB/21498/60/I.C.A.).

22 Sept.—Argentina. Ten diesel-electric locomotives. Argentine State Railways Administration, Av Corrientes 389, Buenos Aires. B.o.T. (ESB/21045/60).*

22 Sept.—Formosa. One electric hospital elevator. Central Trust of China, Purchasing Dept., 68 Yen Ping Nan Rd, Taipei, Taiwan. B.o.T. (ESB/21901/60/I.C.A.).

22 Sept.—New Zealand. 312,562 ft p.i.l.s. telephone cable. Director-General (Stores Division), G.P.O., Wellington. B.o.T. (ESB/20786/60).*

23 Sept.—Durban. kWh/kVAh indicator type summator demand metering equipment. Town Clerk, City Hall, West St, Durban.

26 Sept.—India. Eight items multi-core control and power cables for interconnecting circuits in 66 kV and 110 kV substations, from 2·5 mm to 25 mm, ferrules and cable end boxes.

26 Sept.—India. 50 11 kV pole-mounted type automatic reclosing oil circuit-breakers. Chief Engineer (South), Store Purchase Section, The Mall, Patiala.

26 Sept.—Nigeria. Supply and erection of electrical plant in Lagos vicinity substations for Electricity Corporation. Indoor and outdoor 33 kV switchgear with control and relay equipment, earthing equipment. Substation transformers. Resident Engineer, The Electricity Corporation of Nigeria, Adelphi, John Adam St, London W.C.2. Deposit £12.

27 Sept.—Pakistan. All materials, except power transformers, for four 66 kV substations. West Pakistan Water and Power Development Authority, Lahore.

1 Oct.—Pakistan. 4.440 10 A, 1,000 40 A and 500 3 by 20 A 230 V, 50 c/s house service meters. Director-General, Dept. of Supply and Development, Frere Rd, Karachi. B.o.T. (ESB/20774/60/ICA).*

CONTRACTS PLACED

Buckinghamshire C.C. Electrical installation, Woburn County Secondary School. J. W. Cubbage and Son, Dashwood Ave, High Wycombe.

Downham R.D.C. Electrical installations, 42 houses at Wimbotsham, Denver, Hilgay and Ten Mile Bank. Eastern Electricity Board, £11,157.

Edmonton B.C. Electric goods lift for Claverings Industrial Estate, block H. Evans Lifts, 66 Victoria St, S.W.1, £1,740. (Recommended.)

Esher U.D.C. Supply, erection and wiring of 178 concrete and 14 steel columns. Gallagher and O'Brien Enterprises, Cumberland Chmbrs, Church Gate, Loughborough, £13,040.

Eston U.D.C. Supply, erection of 51 street lighting units, High St and Church La. Cohen Bros. (Electrical) Ltd., 11 King Edward Bldgs, Bury Old Rd, Manchester 8, £1,987.

Hull. Electrical installations at Hull University Scientific Department. Stewart Maggs, 41 Victoria St, Doncaster, £80,000.

King's Lynn B.C. Town Centre lighting scheme. Abacus Engineering Ltd., Russell Chmbrs, 2 King St, Nottingham, £2,761. (Recommended.)

Leighton Buzzard U.D.C. Supply, erection and wiring 62 Group "A" columns and removal and re-erection of 41 Group "B" columns plus provision of AEI lanterns. Gallagher and O'Brien Enterprises, Cumberland Chmbrs, Church Gate, Loughborough, £4,112.

Nottingham T.C. Supply, erection and wiring of steel columns on A1, Midland Lighting and Building Ltd., 167 London Rd, Leicester.

Peterborough. Electrical installation in St. Mark's County School for Joint Education Board. Peterborough and District Electrical Services, 8a Midgate, £1,156.

Richborough. Construction of superstructure of Power Station for CEB. Mott Hay and Anderson, consulting engineers, 9 Iddesleigh Hse, S.W.1. Turriff Construction Corpn., Warwick, £650,000.

Ripley U.D.C. Installation of Class "B" lighting, Ripley - Ambergate Rd, A610. Gallagher and O'Brien Enterprises Ltd., Cumberland Chmbrs, Church Gate, Loughborough, £2,235.

Southall B.C. Installation of improved lighting. Engineering and Lighting Equipment Co., Sphere Wks, St. Albans, Herts, £11,938. (Recommended.)

Southport B.C. Electrical installations, Maiden Estates Ltd., £3,185, and lift installation, H. Beakell and Co. (Blackburn) Ltd., £1,464 at The Orchards, Ainsdale. Electrical installation at Industrial Trading Centre, Ainsdale, M.A.N.W.E.B., £1,160. (Recommended.)

Tyldesley U.D.C. Supply, erection and wiring of 50 "B" and two "A" concrete columns. Gallagher and O'Brien Enterprises Ltd., Cumberland Chmbrs, Church Gate, Loughborough, £2,063.

Wolverhampton. Electrically heating art gallery for B.C. Hartley Installations Ltd., £2,656.

BUSINESS PROSPECTS

Arbroath. £7,000 works extensions planned at Alma Wks, Millgate, for Francis Webster and Sons.

Battle. Sir Hugh Casson, 7 Thurloe Pl, S.W.7, architect for £60,000 Pestolozzi Children's Village Trust International House for refugee children.

Birkenhead. Robert S. Grinling, 2 Halkin St, Hyde Pk Corner, S.W.1, architect for 3-storey office building at Price St for Government departments.—B.C. Tender: 18 flats and garages, Apple Grove and Well La. Engineer.—Fusion Welding Co. plan workshop extensions, Vine St area. E. F. Blakeley and Co., Bearfort Rd, Liverpool, architects.

Birmingham T.C. Tender: Contract 709, 27 four-storey dwellings, Tessall La, Egghill La estate, Northfield. Architect.—Tersons, 4 Dollis Park, N.3, contractors for £270,000 Edgbaston High School for Girls new buildings.—George Wimpey and Co., Hammersmith, W.6, contractors for £1 million 20-storey shop and office block planned at the Bull Ring for Property and General Investments Ltd.

Bolton. G. and J. Seddon, Little Hulton, Manchester, contractors for new foundry, machining bays, etc. The Walmsley (Bury) Group, on 75-acre site.

Bradford. Brook and Crowther, Albion Wks, Leeds Rd North, Huddersfield, consultants for new abattoir.

Canterbury. Prof Robert Matthew and S. Johnson Marshall, 24 Park Sq East, N.W.1, architects for Church of England Teacher Training College for 400 students.

Cardiff T.C. Tender: 195 dwellings, Rumney, Butetown and Ely North, in three groups. City Architect.—Tender: Teacher Training College, Cyncoed, for 400 students with residential accommodation for 300 students. One-, two- and three-storey construction. Architect.—Hasker and Hall, Longdon Hse, High St, Knowlde, Warwicks, architects for £6 million Rover Car Co. factory.

Castle Donington R.D.C. New offices on Delven La area site planned. Surveyor.

Cheltenham. S.W. Hospital Board, Bristol, plans £74,562 additions and alterations at General Hospital. Architects: Healing and Overbury, Rodney Lodge.

Clogher R.D.C. Tender: 12 houses. Clerk.

Dartford. Woodroffe, Buchanan and Coulter, 5 Bedford Row, W.C.1, architects for development of Joyce Green Hospital, Dartford.

Doncaster. Metropolitan Railway Country Estates plan £¼ million luxury housing estate, Top Hall Farm, Bassacarr. They are also developing a housing estate at Armthorpe and plan shops there.—B.C. Tender: 35 one-bedroom bungalows, contract 698. Architect.

Downpatrick. Northern Ireland Hospitals Authority, Victoria Bldgs, Queen St, Belfast, plan hospital adjoining present Downshire Hospital.

Durham. Clayton and Deas, High Row Chambers, Darlington architects for C.C.'s High Coniscliffe primary school.

East Grinstead. Y. J. Lovell and Sons, Elm Hall, Ship St, contractors for W. and J. Jarvis Ltd. factory and offices.

Ecclesfield P.C. Electrical water heating equipment planned for Chapeltown swimming baths.

Exeter. West of England Institution for the Blind plan Topsham Rd new school. Architects: Stillman and Easwick-Field, 30 John St, W.C.1.

Feltham. Rush and Tomnkins, Station Rd, Sidcup, contractors for £270,000 office block.

Footscray. Eric Firmin and Ptnrs, Thavies Inn Hse, Holborn Circus, E.C.1, architects for £73,000 Allied Suppliers factory.

Gateshead B.C. £9,000 street lighting conversion planned. Surveyor.—G. H. Gray and Ptnrs, 8 Portland Terr, Newcastle-on-Tyne, architects for 35,000 sq ft extensions to Bren Manufacturing Co., Team Valley.

Glasgow. John S. Burns and Sons, 195 Buccleuch St, C.3, plan Finlas St factory.—F. Miller (Textiles), 136 Renfield St, C.2, plan Raithburn Ave clothing factory.—Butters Bros. and Co. plan extensions to McLellan St works.—John A. Grant and Co., 15 Lintlaw Dr, S.W.2, plan machine shop.—L. Sterne and Co., refrigeration machine manufacturers, plan Ballantyne St. extensions.—Grenfell, Barnes and Hargreaves, 12 Guildhall St, Preston, Lancs, architects for £225,000 Hall of Residence at University.—Thomsom McCrae and Sanders, 212 Bath St, Glasgow, architects for B.B.C.'s extensions.—The House of Fraser, 10 Buchanan St, Glasgow, plan departmental stores at £1 million, near Jamaica St.

Greenock (Renfrews). Murrayfield Real Estate Co., Cornhill Hse, 144 West George St, promoters of £5 million town centre development scheme including 150 shops and 800 dwellings.

Gt. Yarmouth. Town Planning and Factories Committee approves plan for eight factories on 12-acre site, Acle New Rd.

Hampshire. Emerton, Franck and Tardrew, 17 Chantry Hse, Eccleston St, S.W.1, architects for £500,000 Bracklesham Bay Hotel conversion scheme, near Lymington.

Harlow. Charles and Read, 27 Chancery La, W.C.2, plan new factory.

Haverhill U.D.C. £11,589 Colne Valley Rd site factories planned.

High Wycombe. Ian Fraser and Associates, 15 Bedford St, W.C.2, architects for £30,000 scheme at Cressex estate for a new factory.

Hollington. R.C. authorities plan replacement of St. Gregory's.

Hove. John Lancaster Radiators, 44 Brunswick St East, plan new factory and offices.

Inverness. N. Regional Hospital Board, Reay Hse, 17 Old Edinburgh Rd, plan Raigmore General Hospital.

Jarrow-on-Tyne. Corporation plans 35,000 sq ft factory, facing Tyne. Engineer.

Johnstone. Scottish Council for the Care of Spastics, Scotscraig Park Rd, Paisley, plan residential school near Meikle, Cosford, at £100,000.

Kingston (Surrey). J. Seymour Harris and Ptnrs, 3 Greenfield Cres, Edgbaston, Birmingham, architects for Murrayfield Real Estate Co.'s Richmond Rd shop/office plan.

Leeds. E. Evan Morgan, 15 Park Row, Leeds, architect for Albion and City Properties shop/office scheme nr. Merrion St.—£20,680 special spastics unit planned adjoining Staningley Occupation Centre.

Liverpool. Bradleys (Chester), City Rd, plan St. James's St factory.—Andrews Bros. (Bristol), 34 Regent St, Liverpool, plan Warehing Rd, Aintree, factory.—James Austin, Speke Hall Rd, Liverpool 24, plan Speke Industrial Estate factory.

London. Tersons, 4 Dollis Park, N.3, contractors for £160,000 industrial premises for Calgary and Edmonton Land Co.—White and Travis, 19 Ludgate Hill, E.C.4, architects for £70,000 Rush and Tompkins workshops, St. John St, E.C.4.—Rush and Tompkins, Station Rd, Sidcup, contractors for James Jones and Co. £18,000 factory extensions, Blakes Rd, S.E.15.—E. S. Boyer, 88 Gray's Inn Rd, W.C.1, architect for £350,000 factory for Heron Construction Co.—Farmer and Dark, Romney Hse. Tufton St, S.W.1, architects for £125,000 seven-storey laboratory for Morgan Crucible Co., at Mount Pleasant, S.W.18.—Hospital Board plans £81,070 scheme for extension at Whittington Hospital and £120,918 work at Hetherwood Hospital.—Pauling Construction Co., 26 Victoria St, S.W.1, contractors for £150,000 office block, St. John's St, E.C.1.—Cluttons, 5 Gt. College St, W.1, surveyors for Finsbury Sq office building.—Bernard Sunley and Sons, Berkeley Sq, W.1, plan Theobalds Rd, W.C.1, office and showrooms.—The Rodwell Group of Companies, Hertford St, W.1, have £4 million development scheme, Highgate Hill, to plans by Oscar Garry and Ptnrs, 66 Gloucester Pl, W.1.—J. Brewster, 16 Porchester Pl, W.2, architect for seven-storey hotel extension at Talbot Sq and Conduit Pl.—Whinney Son and Austen Hall, 37 Norfolk St, W.C.2, architects for £30,000 Uxbridge Rd premises for Midland Bank.—Clayton, Black and Daviel, 16 Dartmouth St, S.W.1, architects for house-shop-office scheme at Reedworth St, etc.—J. E. Sterrett and Ptnrs, 21a Ashley Pl, S.W.1, architects for Cardinal Pole R.C. School, Kenworth Rd, Hackney, E.—E. Mayorcas, 13 David Mews, W.1, architect for £68,000 Vauxhall Manor School, Kennington Rd, S.E. extensions.—J. E. K. Harrison, Easble Hse, High St, S.W.19, architect for St. Saviour's and St. Olave's Grammar School, Southwark.

Maidstone. A. J. Townsend and Co., Lulworth, Maidstone Rd, Rochester, plan four-storey block, Mill St.

Manchester. Francis Shaw and Co. plan £40,000 Gibbon St factory extensions.

Newcastle. R.C. authorities plan school at Fox and Hounds La, sponsored by Rev J. W. Milroy, South Benwell Rd, Newcastle.

Perivale. Associated Lead Manufacturers, Wadsworth Rd, £42,000 extensions planned, contractors: Fassnidge, Son and Norris, High St, Uxbridge.

Peterborough. C. W. Shelton, South St, Stanground, plan Broadway area departmental store.

Port Talbot B.C. Tender: 44 dwellings, Harry site, Sandfields. Engineer.

Runcorn. A.S.M. Company, 121 Percival La, Runcorn, plan Picow Farm Rd factory.

Romford. A. E. Symes, 236 High St, E.15, contractors for Lee Cooper Ltd. factory premises at Tonbridge Rd.

St. Albans. Record Food Products plan 224 London Rd extensions.

Scarborough B.C. £23,700 industrial estate planned at Eastfield.

Sheffield. M. J. Gleeson (Contractors), Sheffield, contractors for Halifax Hall of Residence for Women for Senate of Sheffield University.

Shrewsbury. The Brixton Development Co., 22 Ely Pl, Holborn Viaduct, E.C.1, plan 17 Harlescott industrial estate factories.—**B.C.** Tender: 12 three-storey houses and 12 flats, New St. Surveyor.

Southampton. W. H. Saunders and Son, 22 Brunswick Pl, architects for General Securities Ltd. offices and flats planned for Brunswick Pl.—**B.C.** Tender: College of Technology, East Park Terr. Clerk.

South Shields. £398,353 stage 3 of Marine and Technical College planned.

Stockton-on-Tees. Newcastle Hospital Board plan £1,000 lift, Portrack Hospital.

Swinton and Pendlebury B.C. Tender: 70 Beehive Estate houses. Engineer.

Thetford B.C. Tender: 17 Magdalen St dwellings. Architect: C. L. Lister, Garsett Hse, St. Andrew's Hall Plain, Norwich.

Walton and Weybridge U.D.C. Tender: 54 flats in 5 three-storey blocks, Walton-on-Thames. Engineer and Surveyor.

W. Bromwich B.C. Tender: 132 maisonnettes. Borough Engineer.

Wellington. Birmingham Regional Hospital Board plan out-patients' dept., Wrekin Hospital, and alterations to out-patients' dept. at Warwick Hospital.

Whitburn. Dunlop Rubber Co., Canning St, Edinburgh, plan depot of British Motor Corporation's factory site.—Highland Engineering Ltd., 11 Castle St, Edinburgh, plan two factories.

Wigan B.C. £2,130 traffic signal scheme planned, King St area.

Wigston U.D.C. £75,000 swimming baths/kitchen and servery planned. Surveyor.

Wolverhampton. Sir Alfred McAlpine and Sons, 49 Waterloo Rd, contractors for new buildings, etc., London Aluminium (Containers); Brickkiln St. extensions for Midland Metal Spinning Co.

York T.C. Tender: 82 Chapel Fields dwellings and garages. Architect.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Beam Electrical Company Ltd., 40-41 New Bridge St, Exeter. Nom. cap.: £500. Dir.: Alexander T. Bottomley.

Bowen and West Ltd. Radio, television, electrical and electronic engineers, etc. Dirs.: Raymond J. Bowen, 24 Cardiff Rd, Mountain Ash, and Stanley West.

Crestaweld Ltd., 1 Ryburn Side, Sowerby Bridge, Yorks. Oxy-acetylene, electrical, spot and general welders, etc. Nom. cap.: £2,000. Dirs.: Aubrey A. Perkins, Denis N. Whiteside, John F. Asher and Thomas Chadwick.

V. C. Denly and Company Ltd., 5 Westhead Chambers, George St, Staines, Middx. Electrical engineers and contractors, etc. Nom. cap.: £1,000. Dirs.: Victor C. Denly and Catherine W. C. Denly.

E.D.L. Industries Ltd. Manufacturers of and dealers in electrical and engineering plant, etc. Nom. cap.: £50,000. Dirs.: to be appointed by subs. Subs.: Edward H. Bill, "Mullion," Moor Hall Park, Sutton Coldfield, and Thomas P. Carter.

E. H. Humphries (Norton) Ltd., 36 Brownhills Rd., Norton Canes, Cannock, Staffs. Electrical engineers and general electrical installation contractors, etc. Nom. cap.: £3,000. Dirs.: Ernest H. Humphries and Mavis Humphries.

Electro-Mechanical-Systems Ltd., 715 Fulham Rd, S.W.6. Nom. cap.: £100. Dirs.: Ronald L. Howard and Cecil F. Norris.

Midland Combustion Ltd., 146a Broad St, Five Ways, Birmingham 15. Manufacturers or suppliers of combustion equipment including pumps, electronic and other control equipment, etc. Nom. cap.: £1,000. Dirs.: John W. Perry, William B. Evans and Susan Buckby.

Modern Electric (Bradford) Ltd., 69 Holroyd Hill, Wibsey, Bradford. Nom. cap.: £1,000. Dirs.: Raymond Walker and Norman E. Blakemore.

Morton and Cottenden Ltd., 89 South Fields, Letchworth, Herts. Precision and electrical engineers, etc. Nom. cap.: £500. Dirs.: Frederick J. Morton, Leonard J. Cottenden, F. Duckworth and H. Kent.

Paget and Chilvers Ltd., 136 Muir Park St, Coventry. Electrical engineers and contractors, etc. Nom. cap.: £1,000. Dirs.: Douglas G. Paget and Trevor L. Chilvers.

Schenectady-Midland Ltd., Springfield Chemical Works, Oldbury, Birmingham. Manufacturing, distilling, refining, buying, selling, importing, exporting, storing, packing and transporting and dealing in wire, enamels, varnishes, resins, adhesives, etc. Nom. cap.: £100. Dirs.: to be apptd. by subs. Subs.: Henry J. Nelson and Terence E. Hemming.

Visda Ltd. Manufacturers of and dealers in electronic, electrical, radio, television and domestic devices, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: David Preston and Alan Peterson, 11 Waterloo Pl, S.W.1.

Watson and Brownlow Ltd., 331 Beckett Rd, Wheatley, Doncaster. Manufacturers of and dealers in television, radio and electrical apparatus, etc. Nom. cap.: £100. Dirs.: George E. V. Brownlow, Mrs B. Brownlow and Peter Watson.

W. A. Weston (Radio and Electrical) Ltd., 27 Market Pl, Wirksworth, Derbys. Nom. cap.: £3,000. Dirs.: William A. Weston, Mrs Annie M. Weston and Edmund J. Weston.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Grundig. 785,398. Class 7. Domestic mincing machines, washing machines, etc. 785,399. Class 9. Telephone recording apparatus, irons, domestic cleaning and polishing, kettles, etc. 785,400. Class 11. Cooking apparatus, fans, immersion heaters, etc. Grundig Radiowerke Gesellschaft mit Beschranktung, Furth, Germany.

Saturn 777,599 in design 777,754. Class 7. Clothes washing machines. 777,600 and 777,755. Class 9. Vacuum cleaners, polishing machines, etc. Saturn A.G., Frohburgstrusse 242, Zurich and Im Grut 11, Urdorf-Zurich, Switzerland.

Shandon, in design. B800,159. Class 9. Apparatus, etc. Shandon Scientific Co. Ltd., 6 Cromwell Pl, S.W.7.

Datoflo. 780,511. Class 9. Data processing instruments, etc. Underwood Corporation, 1 Park Ave, New York, USA.

Tagflons. 801,693. Class 9. Conductors, contacts, terminals, etc. Qualcom Ltd., 68 Manor Rd North, Hinchley Wood, Esher, Surrey.

Transtar. 797,870. Class 11. Lighting fittings, etc. Inductive Appliances Ltd., 4 St. Nicholas Bldgs, St. Nicholas St, Newcastle upon Tyne 1.

MEETINGS TO NOTE

MONDAY, 5 SEPT.

A.S.E.E. (Leeds). "Dry Fluid Centrifugal Power Couplings," A. O. Hunt. Great Northern Hotel. 7.30 p.m.

A.S.E.E. (Essex). "Domestic Electric Accidents," S. J. Emerson. Angel Hotel, Ilford. 8.15 p.m.

A.S.E.E. (Sheffield). Chairman's address, R. Peacock. Royal Victoria Hotel. 7.30 p.m.

TUESDAY, 6 SEPT.

A.S.E.E. (W. London). "Panelec Warming System." Windsor Castle Hotel, Hammersmith. 7.45 p.m.

A.S.E.E. (Reading and District). "Testing of New Appliances," H. F. Watson. "Marquis of Lorne," Friar St. 7.30 p.m.

WEDNESDAY, 7 SEPT.

A.S.E.E. (Halifax). "Miniature Circuit-breakers," H. E. Banks. Crown Hotel, Horton St. 7.45 p.m.

A.S.E.E. (N. London). "A.C. Variable Speed Drives," P. H. Jackson. Wood Green Civic Centre. 8 p.m.

A.S.E.E. (Manchester). "Jointing Plastic Cables." Engineers' Club, Albert Sq. 7.15 p.m.

A.S.E.E. (Nottingham). Chairman's address. Mechanics' Institution, Trinity Sq. 7.30 p.m.

A.S.E.E. (Preston). "Electrical Floor-warming," M. Bolser. R.A.F.A. Club, East View. 7.30 p.m.

THURSDAY, 8 SEPT.

A.S.E.E. (Bradford and District). "Kariba Dam Project," G. Lyon. College of Technology. 7.30 p.m.

A.S.E.E. (Brighton, Hove and District). "Cable Jointing," J. Kernaghan. New Imperial Hotel. 7.30 p.m.

FRIDAY, 9 SEPT.

E.T.C.T.A. Meeting to form Scottish branch. Ca'Dore Restaurant, 122 Union St, Glasgow. 6 p.m.

SATURDAY, 17 SEPT.

NATIONAL STUDENTS' AND GRADUATES' CONVENTION. "Computers in Industry." University of Birmingham.

TRADE NOTES

Change of Title. E.D.L. Industries Ltd. became, from 1 Sept, the new trading title of The Electric Depot Ltd. The original name, under which the firm has operated since 1922, has tended to obscure the fact that the Company's interests lie solely in the field of manufacture, and it is felt that the change will remove an ambiguity.

The name of the company marketing Ampex magnetic tape recording equipment in the UK has been changed with effect from 1 Sept from Redwood City Engineering Ltd. to Ampex (Great Britain) Ltd.

Manchester Office. Ramset Fasteners Ltd. have just opened a northern area sales office at Block A, Waterloo Wks, Gorsey Mount St, Stockport. Telephone: Stockport 5581. Mr Alan Horne, already known to Ramset users throughout the UK, has taken over as sales manager at Manchester.

New Branch. The Manchester branch office and warehouse of Charles Churchill and Co. Ltd. will operate from 2-12 The Cres, Salford (Telephone Pendleton 1382) as from 12 Sept.

New H.Q. The headquarters of Remploy Ltd. will be transferred to a new six-storey building, to be called Remploy Hse, at 415 Edgware Rd, Cricklewood, N.W.2, on 3 Oct. Soon afterwards, a new showroom will be opened in Bruton St, Mayfair.

Lamp Machinery. Masters Machinery Ltd., of Ivy St, Rainham, Kent, has been formed as a subsidiary of Bader Machinery Co. Ltd., Walton-on-Thames, to manufacture incandescent and fluorescent lamp-making and similar machinery.

Repairs. Already engaged in the manufacture of electric motors, Vale Electrical Works, 3 Kalasipalayam, Bangalore 2, India, also have facilities for the repair of all types of electrical equipment, we understand.

New Works and Offices. Millns Electrical Co. Ltd. announce that as the factory at Fetter La, E.C.4, had become too small for ever-increasing work for switchboards, cubicles, etc.—they have transferred works, stores and offices to a new modern factory at Victoria Rd, Burgess Hill, Sussex.

Gazette Announcements

BANKRUPTCY ACTS

Receiving Orders

Blackpool. S. C. Smith, electrical dealer, lately of 15 Bowness Ave, Mereside, and 178 Watson Rd, Blackpool. Receiving order dated 18 Aug.

Merthyr Tydfil. Beacon Electric Co., 9 Maesyberllan, Trecastle. Date of receiving order: 19 Aug.

Sheffield. C. Roberts, formerly trading as Andor Electrics, at 27 High St, Doncaster. Date of receiving order: 18 Aug.

Sheffield. J. W. Trickett, electrical domestic appliance dealer, 6 Turner La, Whiston, nr. Rotherham. Date of receiving order: 23 Aug.

Public Examinations

Blackpool. J. W. Jones, dealer in electrical appliances, 1 Mount St, Blackpool. Public examination: 10.30 a.m., 19 Oct., at the Court Hse, South King St, Blackpool.

Sheffield. A. W. Westlake, electrician, 42 Park Rd, Conisborough. Public examination at 2 p.m., 13 Oct., at County Court Hall, Bank St, Sheffield.

Appointment of Trustee

Sheffield. S. D. Archer, domestic electrical appliance retailer, 100 Attercliffe Common. Trustee: Mr P. Cardwell, 93 Queen St, Sheffield.

Rescinding Order

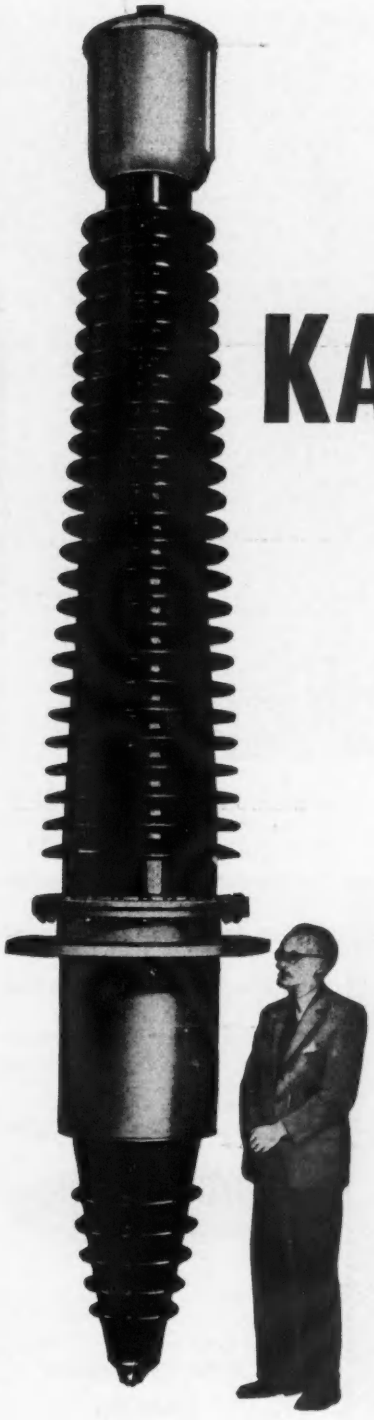
Cardiff. N. G. Morgan, electrician, of 28 Major Rd, Canton. Receiving order dated 25 June, 1959, rescinded as from 19 July, all debts having been paid in full.

COMPANIES ACTS

Blackburn Appliance Co. Ltd. Resolution for voluntary winding-up passed at meeting on 19 Aug. Mr R. Holden, 43 Preston New Rd, Blackburn, appointed liquidator.

Elizabethan Dynamatic Ltd. Meeting of creditors at Winchester Hse, E.C.2, on 7 Sept., at 11.45 a.m.

Springhill (Electrical Maintenance) Ltd. First meeting at official receiver's office, 20 Byrom St, Manchester 3, on 7 Sept. at 11 a.m.

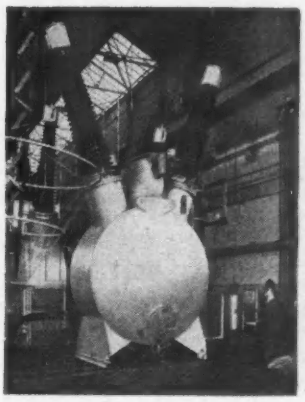


KARIBA at 330 kV.

All the bushing porcelains for the 330 kV. circuit breakers
All the 330 kV. strain insulators for the substations
and the 330 kV. post insulators for some of the substations
by

BULLERS

MAIN CONTRACTORS · AEI LTD.
CONSULTING ENGINEERS MERZ & McLELLAN.



The illustrations show a complete 330 kV. bushing insulator and a 330 kV. circuit breaker, by courtesy of the AEI Ltd.

BULLERS LIMITED · MILTON · STOKE-ON-TRENT · STAFFS

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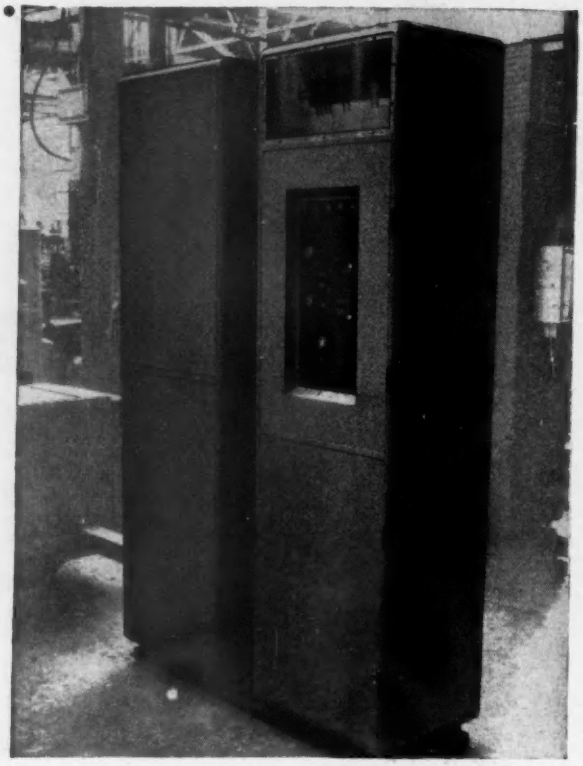
London: 6, Laurence Pountney Hill, E.C.4. *Telephone: MANsion House 9971*

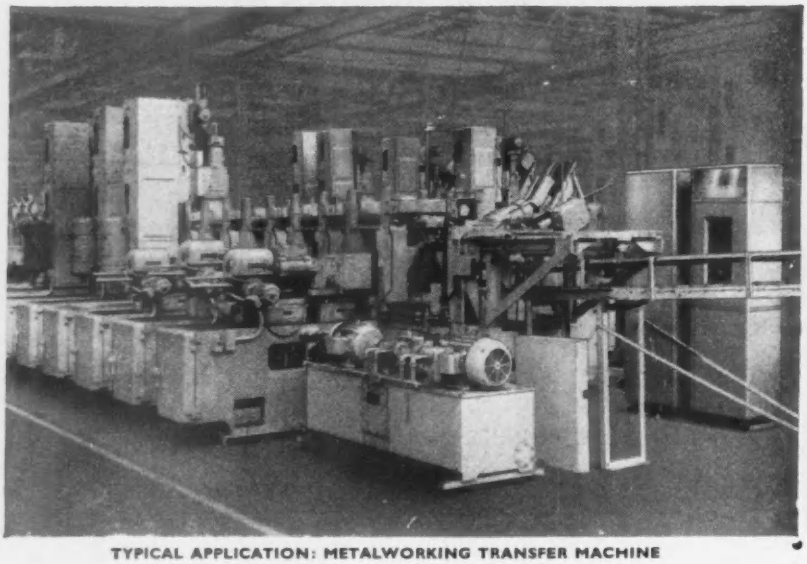
ACCESS a static switching system using Cold-Cathode Tubes, possesses the advantage of self indication.

Access

Austin Cold-Cathode Electronic Switching System, made under licence from the Austin Motor Co. Ltd., and Hivac Ltd.



MASTER CONTROL CUBICLE



TYPICAL APPLICATION: METALWORKING TRANSFER MACHINE

The control system is suitable for many applications including complex machine tool and conveyor installations.

Write for Technical Literature.

The Donovan Electrical Co. Ltd.

ELECTRONICS DIVISION
SAFUSE WORKS · NORTHCOTE ROAD
STECHFORD · BIRMINGHAM 33
Telephone: STECHFORD 2277 (5 lines)

CLASSIFIED ADVERTISEMENTS

TENDERS INVITED

METROPOLITAN WATER BOARD

THE Board are preparing lists of firms able and willing from time to time to tender for the execution of the undermentioned work or the supply of any of the goods or articles and services respectively indicated below. Persons and firms desirous of having their names included in these lists are invited to apply to the undersigned for the requisite form.

Accumulators.

Electrical Equipment (Motors, Alternators, H.T. and L.T. Switch and Control Gear, Transformers, Rectifiers and Accessories).

Electrical Installation Work and Cable Laying.

All persons and firms will be notified of the result of their application to be placed on the lists.

S. D. ASKEW,
Clerk of the Board.

Offices of the Board, New River Head,
Rosebery Ave, London E.C.1. (R 851)

WILLENHALL URBAN DISTRICT COUNCIL

TENDERS are invited for the electrical rewiring of the Town Yard at the rear of the Town Hall, Willenhall, Staffs.

Forms of Tender and Specification may be obtained from the office of the Engineer and Surveyor, Town Hall, Willenhall, where drawings may be inspected.

Tenders in plain sealed envelopes endorsed "Tender for Rewiring" must reach the Clerk of the Council, Town Hall, Willenhall, not later than 20 Sept., 1960.

JOHN R. RIDING,
Clerk of the Council.

Town Hall,
Willenhall, Staffs. (R 852)

APPOINTMENTS VACANT

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

LITTLEBROOK GENERATING STATION
DEVELOPMENT ENGINEER

Vacancy No. 182/60T.

THIS important post requires a man of foresight and initiative in planning future maintenance activities in the light of economics of operation and changing operating patterns. He will act in an advisory capacity under the deputy Power Station Superintendent and should possess the personality and ability to enthuse others.

Basic requirements are a sound technical background and experience of planning and co-ordination in a modern Power Station.

Salary: N.J.B. Class L, Grade 8, £1,400/£1,550 per annum including London Allowance.

Applications giving age, details of experience, qualifications, etc., and quoting vacancy number, should be sent to the Station Superintendent, Littlebrook Power Station, Nr. Dartford, Kent, to arrive by 14 Sept., 1960.

W. H. DUNKLEY,
Divisional Controller.
(R 841)

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

DEPUTY STATION SUPERINTENDENT
COVENTRY POWER STATION

Vacancy No. 200/60.

APPLICANTS should preferably be Corporate Members of the Institution of Electrical Engineers and/or the Institution of Mechanical Engineers and experience in the efficient combustion of fuels on Chain Grate Stokers would be an advantage.

A wide knowledge of the operation and maintenance of a modern generating station and sound administrative and organising ability are essential.

The salary will be within Class G, Grade 3 (£1,440/£1,610 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 9 Sept., 1960.

This appointment will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Station Superintendent, and should be returned to the Station by the date stated.

ASSISTANT SHIFT CHARGE ENGINEER
NORTH WILFORD POWER STATION

Vacancy No. 201/60.

Applications are invited for the position of Assistant Shift Charge Engineer at North Wilford Power Station, Queens Drive, Nottingham.

Applicants should preferably possess the Higher National Certificate or its equivalent, and have had responsible experience in the operation of modern Power Station plant. Pulverised Fuel experience will be an advantage.

Salary for the appointment will be in accordance with Class K, Grade 8 (£1,275/£1,410 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 9 Sept., 1960.

ASSISTANT SHIFT CHARGE ENGINEER
COVENTRY POWER STATION

Vacancy No. 202/60.

Applications are invited for the position of Assistant Shift Charge Engineer at Coventry Power Station, Alderman's Green, Coventry.

Applicants are required to take charge of shift operation of Boiler House plant and must possess a sound technical training, a good general engineering experience, and knowledge of the control and operation of water tube boilers, ancillary plant and the efficient combustion of fuels and Chain Grate Stokers.

Salary will be in accordance with Class G, Grade 9 (£965/£1,090 per annum) of the National Joint Board Agreement, plus 10% shift enhancement.

Closing date for receipt of applications: 9 Sept., 1960.

ASSISTANT MAINTENANCE ENGINEER
(ELECTRICAL)
COVENTRY POWER STATION

Vacancy No. 203/60.

Applications are invited for the position of Assistant Maintenance Engineer (Elec-

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trical) at Coventry Power Station, Alderman's Green, Coventry.

Applicants should have received a thorough technical and practical training, with experience in testing protective gear, maintenance of alternators, transformers, switchgear and associated equipment.

Preference will be given to candidates who hold a recognised qualification.

Salary will be in accordance with Class G, Grade 8 (£1,040/£1,165 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 9 Sept., 1960.

FOURTH ASSISTANT ENGINEER
COVENTRY SECTION

Vacancy No. 204/60.

Applications are invited for the position of Fourth Assistant Engineer at Coventry Transmission Section, Victoria Mills, Bulkington, nr. Nuneaton.

Applicants should have experience of maintenance and operation of E.H.T. overhead lines, transformers and switchgear.

Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

The salary will be in accordance with Class BX, Grade 11 (£855/£1,165 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 9 Sept., 1960.

GENERAL ASSISTANT ENGINEER
(CHEMIST)
STAYTHORPE POWER STATION

Vacancy No. 205/60.

Applications are invited for the position of General Assistant Engineer (Chemist) at Staythorpe Power Station, Staythorpe, nr. Newark.

Candidates must have had a sound technical training and previous laboratory experience and should preferably hold the Higher National Certificate in Chemistry, but consideration will be given to candidates studying for that qualification.

The salary will be in accordance with the National Joint Board Agreement and will be within the range £625/£805 per annum.

Closing date for receipt of applications: 9 Sept., 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Station Superintendent or Section Engineer concerned, and should be returned to the Station by the date stated.
(R 847)

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

FOURTH ASSISTANT ENGINEER
(SERVICES)
CANTERBURY DISTRICT

Vacancy No. 121B/60/T.

CANDIDATES must possess either an engineering degree, the H.N.C. in electrical engineering or equivalent qualifications. The work consists of commissioning the major electrical plant and its associated protective and control gear installed in the power stations and grid substations working at voltages up to 275 kV. The D.C. cross-channel project is also in this area.

Salary: Class AX, Grade 11, £855/£1,090 per annum with prospect of promotion to Grade 9, £1,005/£1,245 per annum, subject to satisfactory progress.

Applications, giving age, details of experience, qualifications, present position, etc., and quoting vacancy number should be sent to the Personnel Officer, Central Electricity Hse, Lower Ham Rd, Kingston upon Thames, Surrey, to arrive by 14 Sept., 1960.

W. G. DUNKLEY,
Divisional Controller.
(R 840)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 40s. per inch, and all other classified advertisements at 3s. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

ELECTRICITY CORPORATION OF NIGERIA

Vacancies for Electrical Engineers, Grade I

APPLICATIONS are invited from suitably qualified Nigerians for appointments with the Electricity Corporation of Nigeria as Electrical Engineers, Grade I.

Qualifications:

Applicants must possess a degree in electrical engineering from a recognised University or its equivalent and about two years' experience in the electricity supply industry, preferably on distribution and transmission.

Candidates who have successfully completed a degree or diploma course but have not yet obtained the required practical experience may also apply. Arrangements will be made for such candidates to receive practical training either at home or abroad.

Salary:

Scale 12 (Lower and Middle segments), £1,095 x £52—£1,251/£1,303 x £63—£1,681 per annum.

Conditions of Service:

Appointment will be pensionable and will be on probation for three years. Leave will be granted at the rate of five days for each completed month of leave-earning service. Car advance will be issued up to a maximum of £750, refundable over four years plus 3% interest. Basic Car Allowance of £156 or £180 per annum will be paid depending on posting.

Quarters:

Where quarters are provided, rent will be payable at the rate of 8½% of basic salary up to a ceiling of £150 per annum. Where quarters are not provided, rent allowance up to a maximum of 6½% of basic salary will be paid.

Method of Application:

Further particulars and application forms may be obtained from The Resident Engineer, Electricity Corporation of Nigeria, Adelphi, John Adam St, London W.C.2. (R 811)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

Central Gloucestershire Sub-Area

TRANSPORT OFFICER (HEADQUARTERS)

The main duties of the post will be to advise on and co-ordinate the operation and day-to-day maintenance of a fleet of some 300 vehicles in accordance with the Board's Scheduled Preventive Maintenance Scheme. The vehicles comprise cars, vans, lorries, mobile plant and special-purpose vehicles stationed at Sub-Area Headquarters and at various detached District Depots. Duties also include the keeping of records of inspections of lifting tackle and the follow-up of cases where inspections have revealed any fault or weakness in this apparatus. Applicants should have had experience in the operation and maintenance of a mixed fleet of vehicles and possess a sound background knowledge of automotive engineering. Appropriate qualifications desirable. Salary: £1,115/£1,245 per annum (N.J.B. Grade K.10). Previous applicants for this post should not re-apply.

SECOND ASSISTANT DISTRICT ENGINEER (DEAN FOREST)

Experience necessary in all Branches of distribution work including construction, maintenance and operation of high and low voltage underground and overhead systems and substations. Technical qualifications desirable. Salary: £965/£1,090 per annum (N.J.B. Grade E.7).

Apply by letter within 14 days stating age, experience, qualifications, present salary and position to Mr S. Raybould, Sub-Area Manager, Midlands Electricity Board, Eastern Ave, Gloucester.

Shropshire & Herefordshire Sub-Area

DISTRICT ENGINEER (SHREWSBURY)

The successful candidate will be responsible to the District Manager for all engineering matters and should have had extensive experience in the construction, operation and maintenance of H.V. and

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L.V. systems. Technical qualifications desirable. Salary: £1,350/£1,500 per annum (N.J.B. Grade E.2). Apply by letter within 14 days stating age, experience, present salary and position to Mr W. Winwood, Sub-Area Manager, Midlands Electricity Board, Spring Gdns, Ditherington, Shrewsbury.

Worcester & District Sub-Area

SECOND ASSISTANT DISTRICT ENGINEER (KIDDERMINSTER)

Duties involve construction, maintenance and operation of H.V. and L.V. Distribution Systems. Technical qualifications desirable. Salary: £1,040/£1,165 per annum (N.J.B. Grade F.7).

THIRD ASSISTANT DISTRICT ENGINEER (KIDDERMINSTER)

Duties involve the construction, maintenance and operation of H.V. and L.V. Distribution Systems. Technical qualifications desirable. Salary: £890/£1,015 per annum (N.J.B. Grade F.9).

Apply by letter within 14 days stating age, qualifications, experience, present position and salary to Mr R. Mallet, Sub-Area Manager, Midlands Electricity Board, P.O. Box No. 52, Blackpole Rd, Worcester.

WAYLEAVE OFFICER (REDDITCH/BROMSGROVE)

Duties include plotting of routes and the negotiation and preparation of Wayleave Agreements, etc. Salary: £700/£775 per annum (N.J.C. Grade 2). Apply by letter within 14 days stating age, experience, present position and salary to District Manager, Midlands Electricity Board, Windsor Rd, Redditch.

F. W. CATER,
Secretary.
(R 831)

LEEDS COLLEGE OF TECHNOLOGY

Calverley Street, Leeds 1

PRINCIPAL: C. CHEW, M.SC.(TECH.), F.R.I.C.

LECTURER IN ELECTRICAL ENGINEERING

APPLICANTS should have a good university degree or equivalent professional qualification and preferably have had experience on the light current side.

Burnham Technical Scale: £1,370 x £35—£1,550.

Further particulars and form of application from the Principal of the College: stamped addressed envelope requested.

GEORGE TAYLOR,
Chief Education Officer.
Education Department,
Leeds 1. (R 821)

AIR MINISTRY

REQUIRE ASSISTANT MECHANICAL and ELECTRICAL ENGINEERS for design, construction and maintenance of installations on airfields, radar stations, missile bases, workshops and maintenance units for R.A.F. at home and overseas as well as certain Civil Airports. Salary: £805 at 25 to £1,095 at 34 or over, thereafter rising to max. £1,260 with increase for London and slight decrease for country districts. Appointments non-pensionable but long term. Promotion prospects. Five-day week with four weeks' and two days' leave a year initially. Special allowance in addition to salary during overseas service. Qualifications and experience:

(i) (a) University degree or equivalent diploma in electrical and/or mechanical engineering with at least two years' apprenticeship; or
(b) Graduate or corporate member of I.E.E. with at least three years' apprenticeship; or
(c) Graduate or corporate member of I.Mech.E., appreciable electrical engineering experience with at least three years' apprenticeship; and

(ii) Have been employed for minimum of two years with well established engineering concern and gained wide experience in both electrical and mechanical engineering practice.

Applicants must be natural born British subjects between ages of 25 and 45. Forms from Ministry of Labour, Technical and Scientific Register (K), 26 King St, London S.W.1, quoting D.158/OA. (R 707)

THE NORTH EASTERN ELECTRICITY BOARD

Harrogate Sub-Area

SUB-AREA COMMERCIAL OFFICER

APPLICATIONS are invited for the appointment of Sub-Area Commercial Officer at Sub-Area Headquarters, Harrogate.

Applicants should have had wide experience of commercial practice and distribution in electricity supply, including development work in urban and rural areas.

Salary in accordance with N.J.M. and H.E. Grades Agreement, Class A, Grade 5, £1,540/£1,740 per annum.

Applications with fullest details should be marked "Confidential" and be received by the Assistant Secretary (Establishments), The North Eastern Electricity Board, Carliol Hse, Newcastle upon Tyne 1, not later than 16 Sept., 1960. (R 824)

LONDON ELECTRICITY BOARD

SENIOR SALES REPRESENTATIVE

APPLICATIONS are invited for the above position in the Board's Central District. The successful applicant will be based at Falcon Hse, Aldersgate St, E.C.1, but will be required to work anywhere in the District, and will, from time to time, be called upon to undertake duties in the Showrooms.

Applicants should be capable of carrying out an energetic sales policy and be thoroughly conversant with supply matters, tariffs, apparatus, and sales to consumers with domestic or small commercial or industrial installations. The possession of the E.D.A. Salesmanship Certificate would be an advantage.

The post is graded within the National Joint Council Agreement (Administrative and Clerical Grades) as Grade 2, i.e., £700/£775 per annum, plus the appropriate London Area Allowance.

Application form obtainable from the Personnel Officer, 46 New Broad St, E.C.2, to be returned completed within 14 days of the publication date of this notice. Please quote ref.: PER/V/3041/T. (R 815)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Edinburgh and Borders Area

THIRD ASSISTANT ENGINEER (PLANNING AND DEVELOPMENT) AREA HEADQUARTERS DEWAR PLACE, EDINBURGH

SALARY: N.J.B. SCHEDULE A, CLASS I, GRADE 10 (£1,190/£1,325 PER ANNUM)

APPLICANTS for this appointment should have a sound engineering training and subsequent experience in the design and layout of densely loaded distribution networks in City areas and also of rural systems at pressures up to and including 33 kV. A knowledge of the application of modern protective equipment and of the calculation and preparation of load flow diagrams and fault levels will be necessary. Applicants must also possess as a minimum qualification a Higher National Certificate in Electrical Engineering or its equivalent.

Conditions of service will be in accordance with the National Joint Board Agreement for the Electricity Supply Industry. The successful candidate, subject to satisfactory evidence of health, will require to become a contributor to the Board's Superannuation Scheme.

The successful candidate will require to reside within a reasonable distance of Area Headquarters.

Applications, on the standard form, obtainable from the undersigned or any other Area Manager, should be submitted not later than 16 Sept., 1960.

C. H. A. COLLYNS,
Manager.
52 Melville St,
Edinburgh 3. (R 825)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

THE NORTH WESTERN ELECTRICITY BOARD

DISTRICT COMMERCIAL ENGINEER
SOUTH DISTRICT, CHEADLE

DUTIES will include the organisation and control of commercial staff and functions in the District; supply of information and advice to consumers on all commercial matters; control of contracting section; control of Service Centres and exhibitions.

Corporate Membership of the Institution of Electrical Engineers will be an advantage.

Salary Scale: £1,535/£1,720 p.a. Grade G.2. N.J.B. Conditions.

FOURTH ASSISTANT DISTRICT COMMERCIAL ENGINEER
(TECHNICAL SALES AND SERVICE)
SOUTH WEST DISTRICT, ALTRINCHAM

Applicants should be capable of assisting the Technical Sales and Service Engineer in connection with industrial and commercial matters. Good technical training essential.

Salary Scale: £825/£940 p.a. Grade J.13. N.J.B. Conditions.

Application forms to be obtained from the Manager (Staff Vacancy), No. 1 Sub-Area, The North Western Electricity Board, Town Hall, Manchester, P.O. Box 493, and returned to him by 12 Sept., 1960.

THIRD ASSISTANT DISTRICT ENGINEER (TECHNICAL)
WIGAN DISTRICT

The duties will be to test and maintain all types of feeder and transformer protective gear within the District. Qualifications to H.N.C. standard are desirable.

Salary Scale: £965/£1,090 p.a. Grade G.9. N.J.B. Conditions.

Application forms to be obtained from the Manager, No. 2 Sub-Area, The North Western Electricity Board, 2 St. George's Rd, Bolton, and returned to him by 12 Sept., 1960.

FOURTH ASSISTANT DISTRICT ENGINEER (DRAUGHTSMAN)
STALYBRIDGE DISTRICT

Applicants should have had sound drawing office experience and a good technical education.

Salary Scale: £765/£870 p.a. Grade H.13. N.J.B. Conditions.

Application forms to be obtained from the Manager, No. 3 Sub-Area, The North Western Electricity Board, Union St, Oldham, and returned to him by 10 Sept., 1960.

SECOND ASSISTANT ENGINEER
SUB-AREA ENGINEERING DEPARTMENT
BLACKBURN

Applicants should be experienced in the operation and maintenance of all distribution and transmission work up to and including 33 kV, together with the maintenance of substations and substation equipment for all high voltages.

Corporate Membership of the Institution of Electrical Engineers will be an advantage.

Salary Scale: £1,440/£1,610 p.a. Grade L.7. N.J.B. Conditions.

Application forms to be obtained from the Manager, No. 5 Sub-Area, The North Western Electricity Board, Jubilee St, Blackburn, and returned to him by 12 Sept., 1960. (R 814)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

ASSISTANT ENGINEERS (DISTRICTS)

FOURTH Assistant Engineers are required in the Meaford and Birmingham Districts of the Electrical Department.

N.J.B. Agreement conditions; superannuable appointments. Salaries within Schedule B, Class BX, either Grade 9, 10 or 11, according to qualifications and experience. The salary ranges are as follows:

Grade 9, £1,005/£1325 per annum.
„ 10, £935/£1,245 per annum.
„ 11, £855/£1,165 per annum.

Candidates should possess a Higher National Certificate in Electrical Engineering, or an equivalent qualification, and should preferably have had some experience on any type of equipment associated with E.H.V. transmission. The selected applicants may be required initially to exchange duties

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for a short period between the District and Divisional Headquarters. Applicants should state if they have a preference for either District.

Apply, quoting vacancy number 226/60MD, on Form AE6, available from the Establishment Officer, 53 Wake Green Rd, Moseley, Birmingham 13, to reach him not later than 12 Sept., 1960.

Previous applicants for this position will be reconsidered. (R 817)

TANGANYIKA GOVERNMENT

ELECTRICAL TECHNICIANS

REQUIRED by Ministry of Urban Local Government and Works for appointment as INSPECTOR (ELECTRICAL) on contract for one or two tours of 30/36 months in first instance. Salary (including Inducement Pay) in scale £1,215 rising to £1,341 a year. Gratuity at rate of 16⅔% of total salary drawn. Outfit allowance £45. Free passages. Liberal leave on full salary.

Candidates, 30/40 years of age, should have served full apprenticeship and possess a National Certificate or equivalent and be fully conversant with I.E.E. regulations. They should have had considerable experience in general electrical installation work and the maintenance of electric generators, motors and industrial switchgear. Write to the Crown Agents, 4 Millbank, London S.W.1. State age, name in block letters, qualifications and experience and quote M2A/51131/EE. (R 829)

UGANDA GOVERNMENT

ELECTRICAL TECHNICIANS

APPLICATIONS are invited for the following posts with UGANDA GOVERNMENT Public Works Department. Appointment on contract for one tour of 30-36 months in first instance. Salary according to age and experience in scale (including inducement pay) £1,056 rising to £1,341 a year. A Salaries Commission is at present in East Africa reviewing salary scales. Outfit allowance £30 payable. Free passages. Liberal leave on full salary.

INSPECTOR OF WORKS (ELECTRICAL)
M2A/50272/EE.

Candidates, aged 30-40 years, must possess O.N.C. (Electrical) or equivalent qualification, have served a full apprenticeship and had subsequent experience in maintenance of industrial electrical equipment and large installations. They must be fully conversant with U.K. Home Office Electricity Rules, Electricity Regulations under the Factories Act and those of the Electrical Commissioners. They should have had experience in organising works programmes and in controlling subordinate staff, materials and funds.

INSPECTOR OF WORKS
(ELECTRICAL REFRIGERATION)
M2A/50846/EE.

Candidates, 30-40 years of age, must possess C. and G. "C" certificate in Electrical Installation and either C. and G. Heating and Ventilation Technical Course Certificate or Science and Technology of Refrigeration Certificate. They should have served full apprenticeship and had at least five years' experience in operation and maintenance of large cold storage plant, air conditioning and ventilating plant and domestic refrigerators.

APPRENTICE MASTER (ELECTRICAL)
M2A/50710/EE.

Candidates, 29-45 years of age, must possess O.N.C. (Electrical), have served full apprenticeship and had considerable subsequent practical experience. Candidates having some experience in training electrical craft apprentices in a large organisation preferred.

Write to the Crown Agents, 4 Millbank, London S.W.1, state age, name in block letters, qualifications and experience, quoting reference of post applied for. (R 813)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

ENGINEERING DRAUGHTSMAN

REQUIRED in the Electrical Engineer's Drawing Office at Divisional Headquarters, Birmingham.

Applicants should have suitable technical training and be capable, under supervision, of preparing detail drawings in connection with the construction of High Voltage Substations.

Salary will be in accordance with either Grades 14, 15 or 16, Class BX of the N.J.B. Agreement within the ranges £825/£940, £765/£870 or £715/£805 per annum, according to qualification and experience.

Applications quoting vacancy number 227/60MD should be submitted on the official form AE6, which may be obtained from the Establishments Officer, Central Electricity Generating Board, Midlands Division, 53 Wake Green Rd, Moseley, Birmingham 13. Closing date for receipt of application: 12 Sept., 1960. (R 820)

KENYA GOVERNMENT

ELECTRICAL TECHNICIANS

TECHNICAL ASSISTANTS, GRADE II (ELECTRICAL), required for one tour of 36/45 months in first instance. Salary according to age and experience in scale (including Inducement Pay) £813 rising to £1,173 a year. Gratuity 13⅓% of total salary drawn. Outfit allowance £40. Free passages. Liberal leave on full salary.

Candidates under 45 years of age must have served full apprenticeship and have had subsequent experience of wiring, cable jointing, overhead line work and general maintenance. They must be capable of installation and supervision of electrical work on building projects and able to instruct junior staff. Write to the Crown Agents, 4 Millbank, London S.W.1. State age, name in block letters, qualifications and experience and quote M2A/51133/EE. (R 828)

LONDON ELECTRICITY BOARD

ASSISTANT DISTRIBUTION ENGINEER

APPLICATIONS are invited for the above position in the Board's Regency District at 38 Aybrook St, W.1.

Applicants should have a sound technical education to the standard of the Higher National Certificate and possess practical experience of all branches of engineering work associated with the organisation of a District distribution department.

The post is graded under Schedule A of the National Joint Board Agreement as Class J, Grade 11, £1,015 per annum, rising to £1,140 per annum, inclusive of London Allowance.

Application form obtainable from the Personnel Officer, 46 New Broad St, E.C.2, to be returned completed within 14 days of the publication date of this notice. Please quote ref.: PER/V/3016/T. (R 827)

LONDON ELECTRICITY BOARD

DEMONSTRATOR

APPLICATIONS are invited for the above position. Initially the successful candidate will be based at 36 Barking Rd, East Ham, E.6, but may be required to work at any Showroom within the Board's Eastern District.

Applicants should be suitably qualified, holding the E.A.W. or other approved certificate, including Electrical Housecraft, and have experience in conducting demonstrations at Showrooms and general Showroom duties. They should also be experienced in advising consumers on the selection and use of domestic appliances, both at the Showroom and on consumers' premises.

The post is graded within the National Joint Council Agreement (Administrative and Clerical Grades) as Grade 1, i.e., £600/£700 per annum, plus the appropriate London Area Allowance.

Application form obtainable from the Personnel Officer, 46 New Broad St, E.C.2, to be returned completed within 14 days of the publication date of this notice. Please quote ref.: PER/V/3003/T. (R 818)

CENTRAL ELECTRICITY GENERATING BOARD

South West Division

GENERAL ASSISTANT ENGINEER
SW/AV/112/60

REQUIRED at Plymouth "B" Power Station.

Superannuation Scheme. Salary: N.J.B. Class H, Grade 13, Scale 4, £765/£870 per annum.

Preference will be given to candidates who hold or are at present studying for a Higher National Certificate or similar qualification. Experience of the analysis of coal, oil and water would be an advantage. Duties will be initially in connection with Oil Firing.

Closing date: 12 Sept., 1960.

SHIFT CHARGE ENGINEER
SW/AV/117/60

Required at Castle Meads Power Station, Gloucester.

Superannuation Scheme. Salary: N.J.B. Class E, Grade 7, Scale 7, £965/£1,090 per annum plus 10% Shift Allowance.

Applicants should have had considerable experience in modern power station operation.

Graduate or Corporate Membership of a recognised Engineering Institution or equivalent desirable.

Closing date: 12 Sept., 1960.

GENERAL ASSISTANT ENGINEER
SW/AV/118/60

Required at Portishead "B" Power Station.

Superannuation Scheme. Salary: N.J.B. Class K, Grade 15, Scale 4, £765/£870 per annum.

Preference will be given to candidates who hold or are at present studying for a Higher National Certificate or similar qualifications.

Previous applicants need not re-apply.

Closing date: 13 Sept., 1960.

(a) THIRD ASSISTANT ENGINEER
(b) FOURTH ASSISTANT ENGINEER
SW/AV/119/60

Required in the System Operation Department at Divisional Headquarters, near Bristol.

Superannuation Scheme. Salary: N.J.B. Class BX, for post (a) Grade 8, Scale 11, £1,105/£1,410 per annum, and for post (b) Grade 9, Scale 10, £1,005/£1,325 per annum.

Duties will be mainly concerned with the estimation of excess generation costs associated with restrictions and outages of generating and transmission plant.

Applicants should have had a good general and technical education to Higher National Certificate standard and should be interested in mathematical and statistical work. Knowledge of power station costs and of the transmission system in the Bristol Grid Control Area will be advantageous.

Please state clearly for which grade application is being made.

Closing date: 14 Sept., 1960.

Applications on Form AE6/ACT obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by the date stated.

Please state Vacancy Number on application.

(R 839)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Third Assistant Engineers

(a) BEDFORD DISTRICT
230/60.N.

(b) EDMONTON DISTRICT (Ref. 988)
233/60.R.

(c) THURROCK DISTRICT
231/60.R.

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems including substations.

Salary: N.J.B. (a) and (c) Class G, Grade 9, £965/£1,090; (b) Class F, Grade 9, £890/£1,015; plus London Allowance for (b) and (c).

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Apply by letter as follows:

(a) R. H. G. Worboys, Manager, Bedford District, Eastern Electricity Board, Prebend St, Bedford, by 16 Sept., 1960.

(b) C. A. Baker, B.SC.(ENG.), LOND., M.I.E.E., Manager, Eastern Electricity Board, 305 Fore St, Edmonton, N.9, by 12 Sept., 1960.

(c) H. J. Unwin, A.M.I.E.E., Manager, Eastern Electricity Board, Maidstone Rd, Grays, Essex, by 16 Sept., 1960.

Chilterns Sub-Area

BEDFORD DISTRICT

DEMONSTRATOR
229/60.R.

Candidates should have had domestic science training including electrical housecraft; should preferably hold the E.A.W. Certificate and be competent to plan and give cookery demonstrations including lectures and advice to consumers on the utilisation of domestic electrical apparatus. Previous experience in an Electricity Service Centre is desirable.

Salary: N.J.C. Grade 1, £600/£700.

Apply by letter to the Manager, Bedford District, Eastern Electricity Board, Prebend St, Bedford, by 24 Sept., 1960.

Northmet Sub-Area

SUB-AREA ENGINEER'S DEPARTMENT, N.14
GENERAL ASSISTANT ENGINEERS
(TELECOMMS.)

OPERATION AND MAINTENANCE SECTION
(Ref. 998) 233/60.N.

Engineers are required for the installation, testing and maintenance of communication equipment including manual and automatic telephone systems, multi-channel carrier telephone apparatus and supervisory remote control equipment. Practical experience in at least one of these fields is essential. A knowledge of electronics and V.H.F. radio would be an advantage.

Salary: N.J.B. Grade 16, £890/£1,015, plus London Allowance.

GENERAL ASSISTANT ENGINEER
OPERATION AND MAINTENANCE SECTION
(Ref. 969) 234/60.N.

Engineers are required for general duties including the commissioning and testing of protective gear, automatic control and communication equipment. Candidates who lack specialist experience but who have a good technical background will be considered.

Salary: N.J.B. Grade 14, £1,040/£1,165, plus London Allowance.

For these appointments apply by letter to the Manager, Eastern Electricity Board, Northmet Sub-Area, Northmet Hse, Southgate, London N.14, by 12 Sept., 1960.

EDMONTON DISTRICT
DISTRICT COMMERCIAL ASSISTANT
(Ref. 997) 232/60.R.

Candidates should be fully experienced in modern installation practice, able to prepare specifications and competitive quotations and be competent to design thermal storage heating schemes, particularly floor warming. A sound knowledge of the tariffs and their application, including supply by special agreement, is necessary.

Salary: N.J.C. Grade 3, £780/£880, plus London Allowance.

Apply by letter to C. A. Baker, B.SC.(ENG.), LOND., M.I.E.E., Manager, Eastern Electricity Board, 305 Fore St, Edmonton, N.9, by 12 Sept., 1960. (R 843)

THE NORTH EASTERN ELECTRICITY BOARD

Tyne Sub-Area

APPLICATIONS are invited for the appointment of THIRD ASSISTANT ENGINEER, Sub-Area Commercial Officer's Staff, at Consumers' Service Depot, Pandon, Newcastle.

Salary: Schedule A, Class L, Grade 10, £1,190/£1,325. N.J.B. conditions of service.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol Hse, Newcastle upon Tyne, within ten days of the appearance of this advertisement. (R 846)

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEER (PLANNING)

SWINDON District of No. 2 (Newbury) Sub-Area. Salary: N.J.B. Class G, Grade 10 (£890/£1,015 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist the Planning Engineer in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks, and to undertake standby duties if required. Applicants should possess suitable technical qualifications.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1234, not later than 12 Sept., 1960.

ASSISTANT ENGINEER
(MAINTENANCE AND OPERATION)

Basingstoke District of No. 3 (Portsmouth) Sub-Area. Salary: N.J.B. Class F, Grade 10 (£825/940 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist with the maintenance and operation of H.V. and L.V. distribution mains and substations and with minor construction work. A technical training to H.N.C. standard and experience of similar work are required.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton La, Cosham, Portsmouth, and returned to him, quoting Z.1109, not later than 12 Sept., 1960.

ASSISTANT ENGINEER (PLANNING)

Basingstoke District of No. 3 (Portsmouth) Sub-Area. Salary: N.J.B. Class F, Grade 11 (£765/£870 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks and to undertake standby duties if required. Suitable technical qualifications are necessary.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton La, Cosham, Portsmouth, and returned to him, quoting Z.1228, not later than 12 Sept., 1960.

SERVICE REPRESENTATIVE

Ealing District of No. 1 (Southall) Sub-Area. Salary: N.J.C. Grade 2 (£700/£775 per annum, plus London Weighting). N.J.C. Conditions of Service.

Applicants should have a general knowledge of application of tariffs and domestic apparatus, together with ability to obtain business and to advise consumers on general matters relating to the supply and use of electricity.

Applications on forms obtainable from the Sub-Area Secretary, 2-6 Windmill La, Southall, Middlesex, and returned to him, quoting Z.1211, not later than 12 Sept., 1960.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. (R 842)

THE SOUTH WALES ELECTRICITY BOARD

SURVEYOR/DRAUGHTSMAN

APPLICATIONS are invited for the position of Surveyor/Draughtsman in the Rhondda District of the Cardiff and East Central Area of the Board.

Salary (provisional): N.J.B. Class F, Grade 12, Scale 3 (£715/£805).

Applications stating age, present position, present salary, qualifications and experience should be addressed to C. L. Townsend, ASSOCIATE I.E.E., Manager, Cardiff and East Central Area, 445/447 Cowbridge Rd East, Cardiff, so as to arrive not later than Saturday, 17 Sept., 1960. Please quote reference 159/60/ET.

Envelopes should be endorsed "Surveyor/Draughtsman."

R. G. WILLIAMS,
Secretary.
(R 844)

CENTRAL ELECTRICITY GENERATING BOARD
London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement Schedule A and B. Salary includes London Allowance.

ASSISTANT ENGINEER (ELECTRICAL)
BELVEDERE POWER STATION

Vacancy No. 60/731.

To carry out electrical commissioning, programming of electrical work, assisting the Assistant Maintenance Engineer as required and capable of taking charge of maintenance section. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage. Salary: Class L, Grade 9, £1,325/£1,460 per annum.

SHIFT CHARGE ENGINEER
BOW POWER STATION

Vacancy No. 60/732.

Considerable experience in efficient operation of turbo-alternators and B. and W. boiler plant essential, together with the character and ability to deal with staff problems. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage. Salary: Class F, Grade 7, £1,090 plus £104 shift per annum.

ASSISTANT SHIFT CHARGE ENGINEER
STEPNEY POWER STATION

Vacancy No. 60/733.

Sound technical training with experience of power station operation preferably on pulverised fuel-fired plant. Character and ability to supervise staff is important. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage. Salary: Class F, Grade 9, £940/£1,065, plus £90/£101 10s shift per annum.

Applicants to Vacancy 60/567 will be reconsidered and need not re-apply.

RELIEF ASSISTANT CHEMIST
DIVISIONAL CHEMISTRY SECTION

Vacancy No. 60/734.

The successful candidate will be attached to the Divisional Chemistry Section, but will be based on Deptford Power Station Laboratory. Duties will include relief work as First Assistant Chemist at any station in the London Division, and when not so engaged will cover those of an Assistant Chemist at Deptford. Experience of power station chemistry is required, with a minimum qualification of H.N.C. Salary: Class TS.BX, Grade 9, £1,055/£1,375 from 1 July, 1960; £1,100/£1,375 per annum from 1 July, 1961.

Applications, quoting Vacancy No. to (or on form from) Personnel Officer, Central Electricity Generating Board, London Division, P.O. Box 136, London W.1, by 13 Sept., 1960. (R 819)

ELECTRICITY CORPORATION OF NIGERIA
Vacancies for Electrical Engineers, Grade II

APPLICATIONS are invited from suitably qualified candidates for appointments with the Electricity Corporation of Nigeria as Electrical Engineers, Grade II.

Applicants should have acquired a wide experience in the electricity supply industry over a fair period. They will be required in addition to submit documentary evidence of educational attainments to the standard of the Higher National Certificate in electrical engineering.

Successful applicants will be engaged mainly on the construction and maintenance of overhead lines and substations up to 33 kV, and sound practical experience in this type of construction work is essential.

Nigerian Officers

Salary:

Scale 14, £1,278 x £42—£1,404.

Conditions of Service:

Appointment will be pensionable and will be on probation for three years. Leave will be granted at the rate of five days for each completed month of leave-earning service. Car Advance will be issued up to a maximum of £750, refundable over four years plus 3% interest. Basic Car Allowance of

continued in next column

continued from previous column

£156 or £180 per annum will be paid, depending on posting.

Quarters:

Where quarters are provided, rent will be payable at the rate of 8½% basic salary up to a ceiling of £150 per annum. Where quarters are not provided, rent allowance up to a maximum of 6½% of basic salary will be paid.

Expatriate Officers

Salary:

Scale 14, £1,278 x £42—£1,404.

Inducement Addition:

£270 per annum.

Contract Allowance:

10% of basic salary.

Gratuity:

The Corporation has a Provident Fund into which it pays 25% of the officer's basic salary plus inducement addition. This gratuity which is payable on the satisfactory completion of contract is free of income tax if the officer remains in the service for five years or more.

Conditions of Service:

Appointment will be on contract for a tour of not less than 18 months and not more than 24 months in the first instance. Leave will be granted at the rate of seven days for each completed month of leave-earning service. First-class passages are provided for officer and wife and, in addition to this, there are two first-class adult return fares which may be used for children to join parents during their holidays, or for the wife to visit her children in the United Kingdom during an officer's tour. Car Advance will be issued up to a maximum of £750, refundable over four years plus 3% interest. Basic Allowance of £156 or £180 per annum will be paid depending on posting.

Quarters:

Quarters will be provided, and rent will be payable at the rate of 8½% of salary up to a maximum of £150 per annum.

Method of Application:

Further particulars and application forms may be obtained from The Resident Engineer, Electricity Corporation of Nigeria, Adelphi, John Adam St, London W.C.2. (R 812)

SOUTH EASTERN ELECTRICITY BOARD
Surrey Sub-Area, Dorking

SENIOR ASSISTANT ENGINEER
(METERS AND METER TESTING ONLY)

SALARY £1,650/£1,830 per annum in accordance with N.J.B. Grade 5, Class L. Superannuable. The appointed person will be responsible to the sub-area engineer for the operation of the meter-testing station at Burford, Dorking, which undertakes the provision, repair and testing of all single and polyphase meters for Surrey sub-area, together with the installation and site testing of all large power metering equipments. Applicants, preferably Corporate Members of the I.E.E., should have extensive responsible experience in a large modern meter-testing station. Applications, quoting ET and naming two referees on forms obtainable from the Surrey Manager, Seeboard, Rough Rew, Ridgeway Rd, Dorking, Surrey, should be returned to him by 21 Sept., 1960.

SECOND ASSISTANT ENGINEER
(PLANNING AND DESIGN)
ENGINEER-IN-CHIEF'S DEPARTMENT
HEADQUARTERS

Salary: £1,440/£1,610 per annum under N.J.B. Schedule B, Grade AX5. Superannuable. Applicants should be Corporate Members of the I.E.E. with a wide experience in all branches of distribution engineering, including the planning and design of underground and overhead distribution and transmission systems up to and including 33 kV. The duties of the appointment will

continued in next column

continued from previous column

be to assist in the examination of proposals for approval, and the preparation of reports and estimates for new transmission schemes. Applications quoting ET and naming two referees on forms from The Engineer-in-Chief, 10 Queen's Gdns, Hove 3, Sussex, by 21 Sept., 1960.

GEORGE WRAY,
Secretary.
(R 838)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD
North Caledonia Area

APPLICATIONS are invited for the following superannuable posts at Area Headquarters, Elgin.

THIRD ASSISTANT ENGINEER
(PROTECTION AND COMMUNICATIONS)

Experience and qualifications in communications or light current engineering an advantage. Salary and conditions of service in accordance with the National Joint Board Agreement, Class G, Grade 10 (£890 x £25—£1,015 per annum).

ENGINEERING DRAUGHTSMAN

Experience in the Supply Industry would be an advantage. Minimum qualifications Ordinary National Certificate. Salary and conditions of service in accordance with the National Joint Board Agreement with placing in the salary range £715/£1,015 per annum depending on experience

The Area is expected to be reclassified to Class H in 1961.

Applications on a form to be obtained from the Manager should be returned to West Villa, South St, Elgin, by 19 Sept., 1960. (R 848)

AC MACHINE DESIGN ENGINEER required (N.E. England). Experience of design, manufacture and testing of large solid rotor alternators and/or salient pole machines essential. Knowledge of design of exciters and motors a further asset. Applicant preferably should have an engineering degree but minimum qualifications Grad. I.E.E. or equivalent. Applications stating age, qualifications, experience and salary required by 12 Sept., 1960, latest, to Box No. 7983, Electrical Times. (R 836)

A LONDON CONSULTING ENGINEER with much established work now requires to staff a number of large new projects of great public interest. The grade most required is that of electrical engineer/draughtsman to work on the preparation of designs and specifications for electrical installations within buildings. The salary for this grade being £750/£1,000 according to experience in this field and qualifications.

Applicants should possess at least an Ordinary National Certificate (preferably a Higher National Certificate) and some practical training.

The organisation, which is well known to industry and commerce, has welfare and social facilities, luncheon voucher issue and a superannuation scheme.

Applicants should state age, experience, qualifications and salary required.—Box No. 7985, Electrical Times. (R 855)

ELECTRICAL DRAUGHTSMAN

required in Consulting Engineers' office in London, O.N.C. standard, for electrical installations in schools, colleges, hospitals, etc. 5-day week, superannuation. Salary according to qualifications. Reply in writing to:

R. W. Gregory and Partners,
21 Bloomsbury Way,
W.C.1.

(R 758)

ELECTRICAL ENGINEER

If you have a good honours degree in Electrical Engineering, are aged between 26 and 30, and would like to join the Commonwealth's largest glass manufacturing organisation, you are invited to write about yourself to the Personnel Officer (Graduate Recruitment), Pilkington Bros. Ltd., St. Helens, Lancashire.

You would take charge of the impulse section of one of the best equipped High Voltage Insulator laboratories in the country, utilising test voltages of up to 2,000 kV. An extensive programme of research and development relating to toughened glass power line insulators is in progress. You do not require to have had previous experience of this type of work, we will arrange appropriate training. (R 830)

ADDITIONAL STAFF. — JUNIOR ENGINEER having distribution experience (preferably with Supply Authority), excavations, cable laying, jointing, switchgear, substations and overhead line construction. FOREMEN capable of dealing with the above.—Written applications to: C. Maurice Contractors Ltd., Lindsey Rd, Bishop's Stortford, Herts. (R 695)

BRITISH Engine Boiler and Electrical Insurance Co. Ltd., Longridge Hse, Manchester 4. ELECTRICAL SURVEYOR required in Scotland. Permanent position carrying progressive salary scale, £800/£1,100, and non-contributory pension. Candidates aged 26 to 32, with H.N.C. in Electrical Engineering or Grad. I.E.E. and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply stating age, qualifications and experience. (R 849)

DRAUGHTSMAN required for the Electrical Division of a large Building Contractor. For interesting work producing drawings for electrical installations in Schools, Factories and Office Blocks. Age 18-22. Good salary, Pension Scheme. State age and training, etc., to Box No. 7973, Electrical Times. (R 809)

ELECTRICAL DRAUGHTSMAN able to apply himself to a wide variety of work. A knowledge of power switchboard construction would be an advantage.—Astral Switchgear Ltd., Alma Rd, Ponders End, Middlesex. (R 807)

UNILEVER LIMITED

require a

Technical Assistant (Electrical)

at their Head Office for the design and layout of complete factory electrification schemes including generation and/or Public Supply. Successful applicant would be required to design, specify and initiate the ordering of electrical equipment and contract installations, control design draughtsmen and contractors, cover technical correspondence and consultative work, witness manufacturers' works tests and site tests and commission projects on completion and pass same for payment. Applicants should be between 25 and 30 years old and must hold the H.N. Certificate in Electrical Engineering. (Preference will be given to A.M.I.E.E. or Grad. I.E.E.) Salary according to age and experience. Applications, in writing, should be addressed to Head Office Staff Department (Ref. WF/66), Unilever Ltd., Unilever Hse, Blackfriars, London E.C.4. (R 832)

REPRESENTATIVE

Well-known manufacturers require top-class man with knowledge of electricity distribution and cable jointing. To be based on London Office. Age 25/35. Remuneration by salary with car and all expenses. Write with full personal details and résumé of career to date.—Box No. 7979, Electrical Times. (R 834)

ELECTRICAL ENGINEER required for Glasgow Office staff, age 23-28. Applicants (H.N.C. minimum) should have had experience in the manufacture of electrical machines. Progressive salary with non-contributory pension. Applications stating age, nationality, qualifications and experience to British Engine Boiler and Electrical Insurance Co. Ltd., 98 West George St, Glasgow C.2. (R 850)

ELECTRICAL ENGINEERING ASSISTANTS required with technical experience in any of the following:

(i) The design of electrical installations for large buildings such as schools, flats or industrial;
(ii) The maintenance and improvement of electrical installations in buildings of the above type;
(iii) The installation and/or maintenance of electric lifts.

Salaries up to £1,250 per annum, depending on qualifications and experience. Staff restaurant on premises. Pension Scheme. Application forms from Chief Engineer (G.S./E.T./2271/9), London County Council, County Hall, S.E.1. (R 859)

ELECTRICAL CONTRACTS SUPERVISOR required for the Electrical Division of a large Building Contractor. Experienced in installations of Schools, Factories, Office Blocks. Capable of handling labour. Aged 35-45. Good salary, Pension Scheme, other attractive conditions. State age, training and experience to Box No. 7971, Electrical Times. (R 808)

BRITISH RAILWAYS

(Southern Region)

require

SEAGOING ELECTRICAL ENGINEERS

for Cross Channel vessels operating between Weymouth and the Channel Islands.

Applicants should have a thorough technical and practical knowledge of modern shipboard electrical installations and equipment. Previous experience in the Royal or Merchant Navy an advantage. Residence in the Weymouth area essential.

- Commencing salary: £736 per annum.
- Travel concessions.
- Superannuation scheme.

Applications giving full details of education, training, technical qualifications and experience to:
Shipping and Continental Manager
Victoria Station
London S.W.1
quoting Ref.: SC/SAS/3352. (R 833)

ELECTRICAL ENGINEERS

required with experience in the installation of L.T. and E.H.T. cables, switchgear, transformers, etc. Good conditions and prospects. Superannuation Scheme. Reply stating age, experience, qualifications and salary required to Box No. 7967, Electrical Times. (R 761)

FOREMAN ELECTRICIAN required in the Wellington District. Duties will include supervision of all types of Domestic, Farming and Industrial Electrical and Wiring installations and organising and controlling of manual labour in this type of work. Conditions of service and salary: £880 per annum, Schedule E, Grade 1, in accordance with N.J.I.C. Agreement. Apply, by letter, within ten days, stating age, experience and present position, to Mr W. Winwood, Sub-Area Manager, Midlands Electricity Board, Spring Gdns, Ditherington, Shrewsbury. (R 854)

ELECTRICAL ENGINEERS

required with experience in the survey and erection of Overhead Lines. Good prospects and conditions. Superannuation Scheme. Reply stating age, experience, qualifications and salary required to Box No. 7965, Electrical Times. (R 760)

JUNIOR DRAUGHTSMAN required by Hackbridge and Hewittic Electric Co. Ltd., Walton-on-Thames, for their switchgear drawing office. D.O. Works training essential with technical training to at least O.N.C.

Reply, stating age and experience, to "The Chief Mechanical Engineer." (R 775)

STOCK RECORDS CLERK required by old-established London electrical wholesaler. Preferably 21 to 23 years of age with some experience in electrical trade.—Box No. 7981, Electrical Times. (R 835)

WANDLESIDE CABLE WORKS LTD. require CHIEF ELECTRICAL ENGINEER for their group of Cable Companies responsible for General Electrical and Technical specifications to their Cable Group Managing Director. Applicants should state age and experience and be familiar with the industry. This is an excellent opportunity for the right man with a really progressive Company. Mark your application "Personal" for the attention of the Managing Director, Wandleside Cable Works Ltd., 106 Garratt La, Wandsworth, S.W.18. All applications treated in strictest confidence. (R 853)

ELECTRICAL DRAUGHTSMEN

Draughtsmen having experience of circuit design of Control Systems are required to assist in the design of Temperature Control Panels. Some experience of sheet metal fabrication is also desirable.

Apply, giving details of experience to the Personnel Manager,

THE RHEOSTATIC CO. LTD.
SLOUGH
BUCKS (R 816)

FULLER ELECTRIC LTD.

require a

CURRENT TRANSFORMER DESIGNER

Applicants should be suitably qualified and must have been previously engaged upon this type of work. Should the successful applicant so desire, he will be given an opportunity to gain experience in power transformer design.

Salary will be commensurate with age, qualifications and experience.

Apply in first instance to:

Personnel Manager
Fuller Electric Limited
Fulbourne Road
London E.17 (R 826)

WANTED

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper Ltd., 17 Brady St, Bethnal Green, E.1. (R 1)

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A.C. and D.C. MOTOR REWINDS and REPAIRS. Prompt service, fully guaranteed. Edgware 5566 (4 lines). — Service Electric Co. Ltd., Stanmore. Middx. (R 2)

L.T. and E.H.T. JOINTING (Henley's trained). Contracts and breakdowns.—Further enquiries to: J. R. Williams, Basildon 21452. (R 822)

AGENCIES

PROGRESSIVE company of ELECTRICAL WHOLESALERS wish to acquire a trading company in London or the Midlands to allow further expansion. This is a good opportunity for a company with active management but limited resources to join forces and benefit accordingly. Alternatively we would acquire a concern where management does not wish to be retained. Companies with assets £15,000-£30,000 considered most suitable. Replies treated in the strictest confidence.—Box No. 7977, Electrical Times. (R 817)

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A.A. ELECTRICAL CO. for A.C.-D.C. MOTORS, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—Chi 5105, 67 Rothschild Rd, W.4. (R 3)

ELECTRIC MOTORS, D.C. and A.C. Motor Generator Sets, Alternators and Dynamos, Diesel Sets, Circuit-breakers, Switchboards, reconditioned and guaranteed. Very large stocks held.—Britannia Manufacturing Co. Ltd., Britannia Walk, N.1. CLErkenwell 5512-3-4. Stores at Chobham, Surrey. (R 7)

HOUSE-SERVICE METERS, A.C. or D.C., quarterly or prepayment.—Universal Electrical, 221 City Rd, London, E.C.1. (R 5)

HOUSE-SERVICE METERS, all types can be obtained by return from Selectrics, Dept. E.T., Meter Hse, Factory Row, Castle Circus, Torquay. Phone 7218. (R 8)

PURLEY CHOKES AND BALLASTS. Our 80 W tapped h.p.f. ballast with starter switchgear-holder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s 6d each subject. —F. W. Blanshard Ltd. (Dept. E.T.), Purley, Surrey. Uplands 4818/9. (R 6)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

Distribution Transformers for Disposal

THE Board have for disposal and invite tenders for the purchase and removal of 105 transformers ranging from 5 to 4,000 KVA, of which 28 are serviceable as taken out of commission, and two balancers and one regulator.

Further details, full particulars as to where they may be inspected, and Forms of Tender on which offers must be submitted may be obtained from The Manager, No. 4 Sub-Area, Merseyside and North Wales Electricity Board, Rhostyllen, Wrexham, Denbighshire.

Tenders must be returned in a sealed envelope as provided so as to arrive not later than noon on Wednesday, 21 Sept., 1960.

The transformers are offered for sale without guarantee as to their condition, and the Board do not bind themselves to accept the highest or any tender and reserve the right to accept the whole or any part of any tender.

M. M. PARKER,
Secretary.
(R 858)

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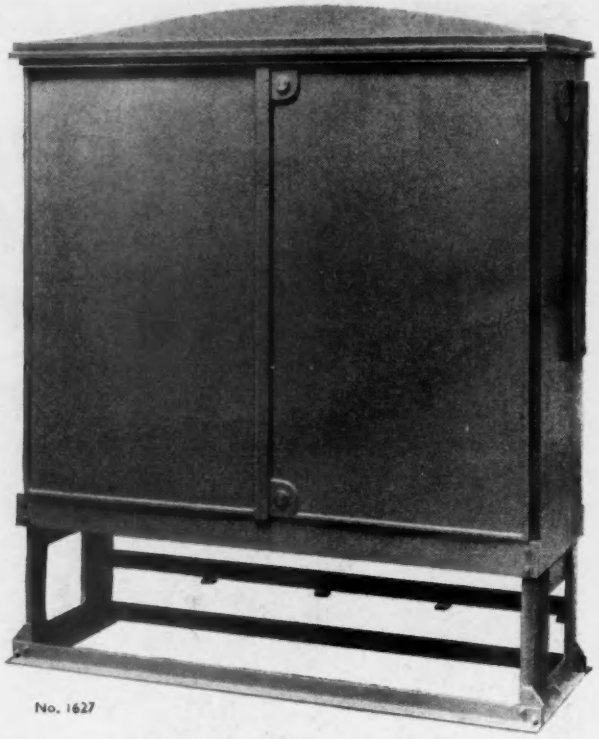

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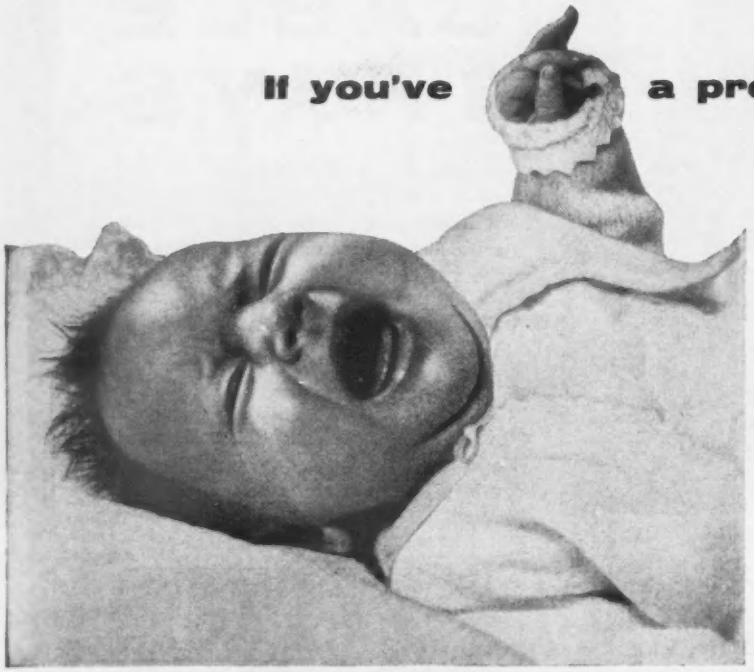

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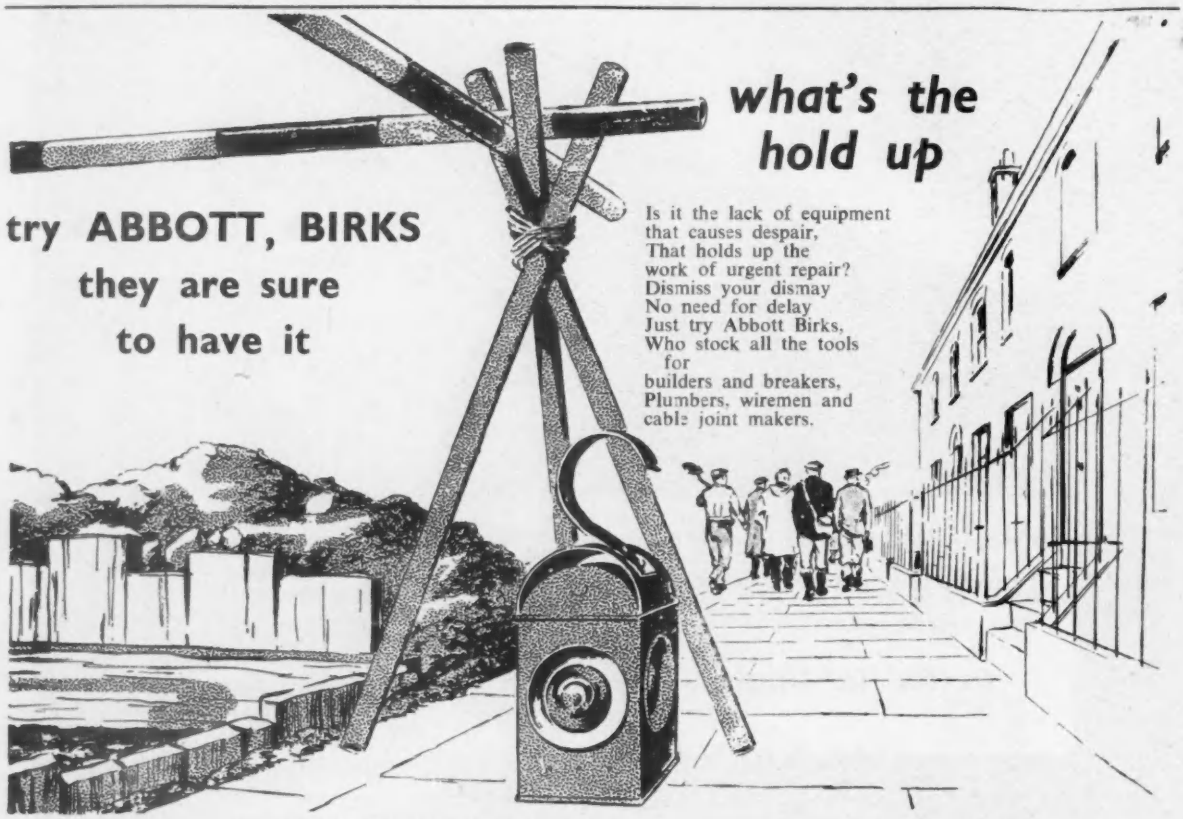

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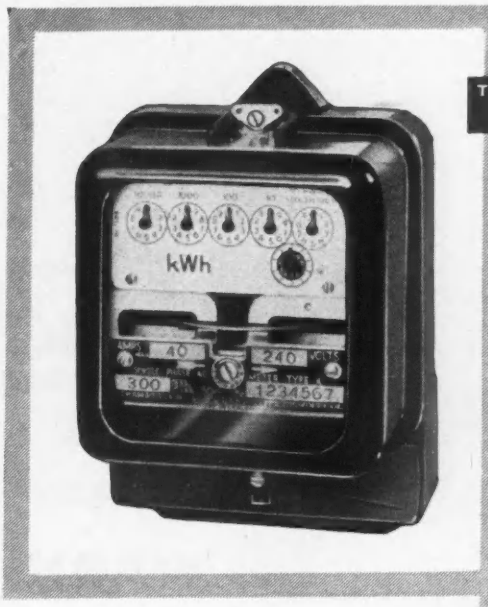

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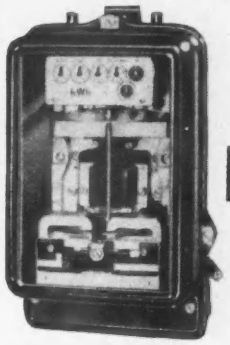

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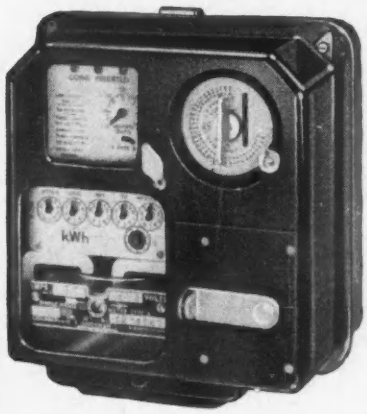

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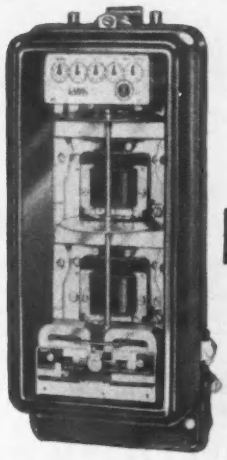

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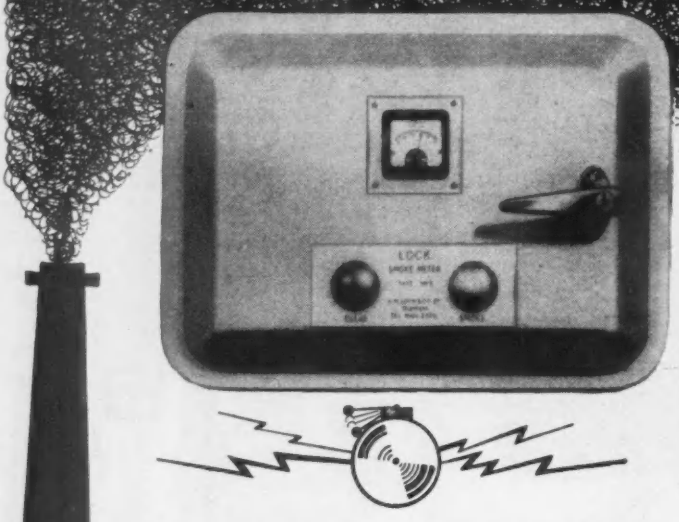

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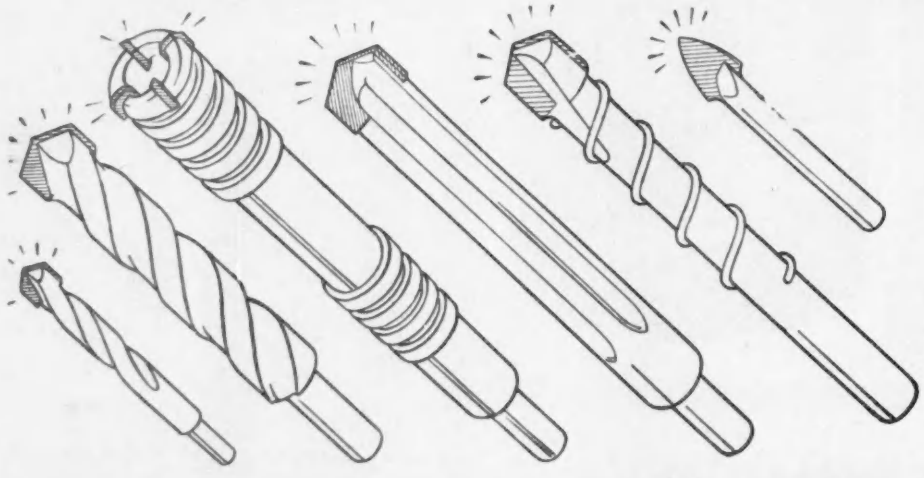

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40 w. 4 ft.	11/9	9/9	1/8	11/9	11/–	1/11	11/–	1/11
40 w. 2 ft.	11/–	9/9	1/8	11/–	11/–	1/11	—	—
30 w. 3 ft.	11/–	9/9	1/8	11/–	11/–	1/11	—	—
20 w. 2 ft.	10/6	9/3	1/7	10/6	10/6	1/10	—	—
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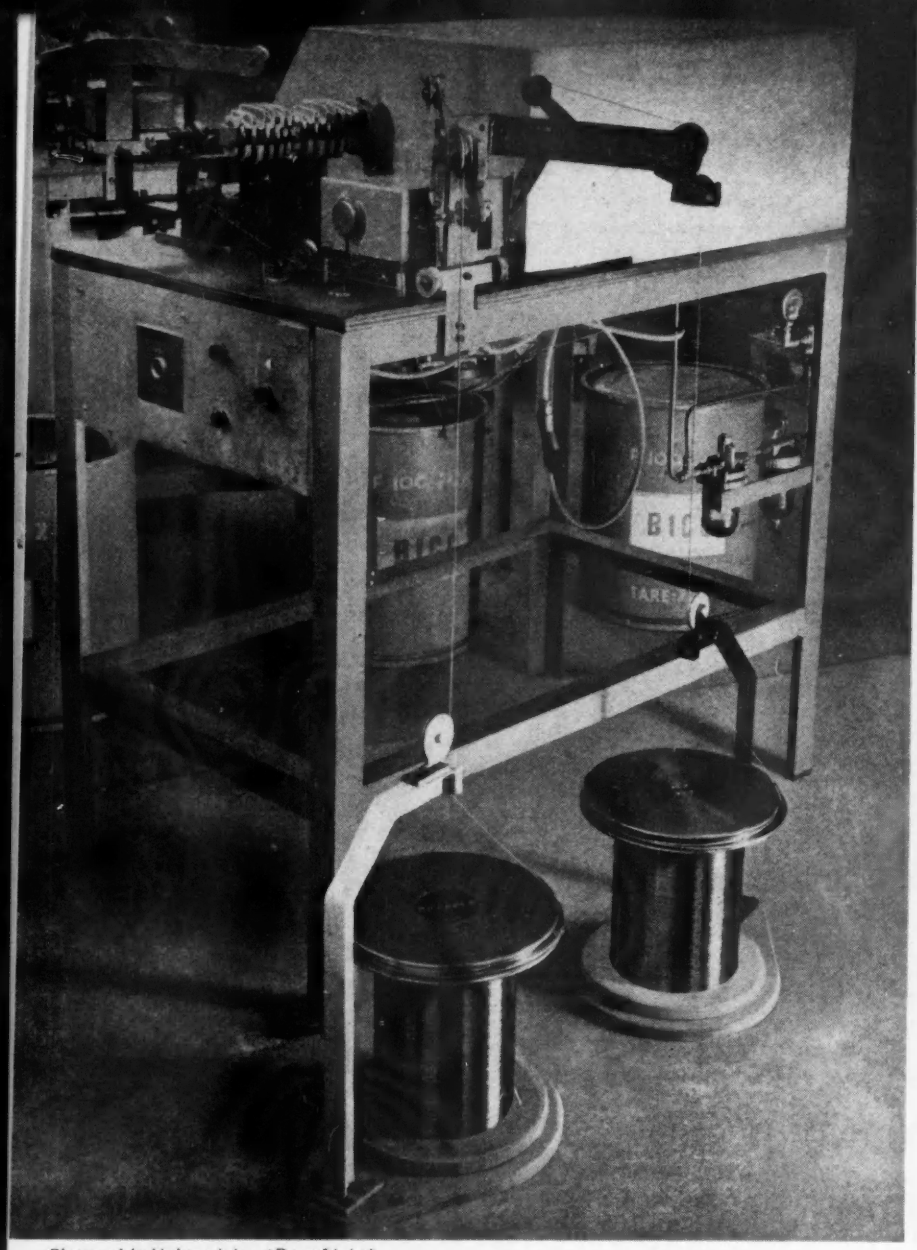

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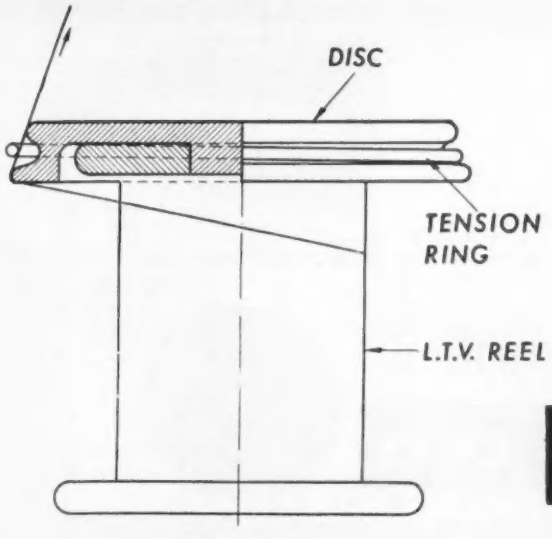

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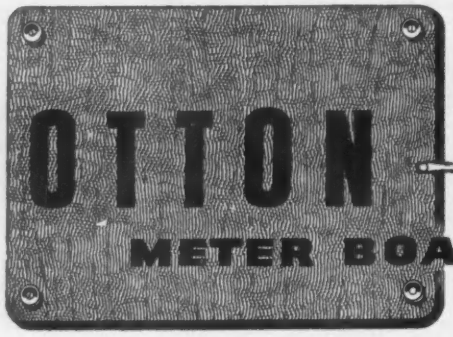

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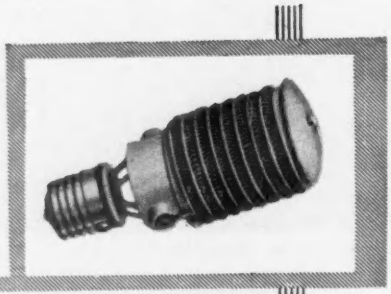

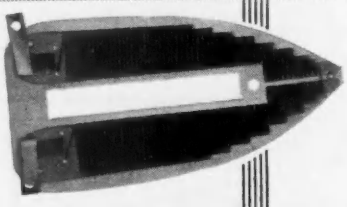

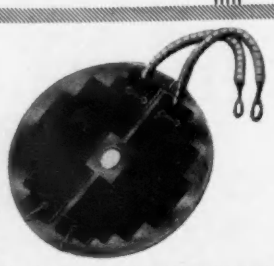

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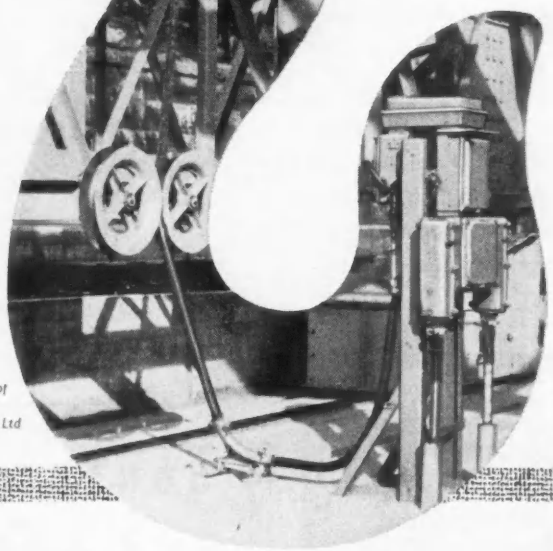

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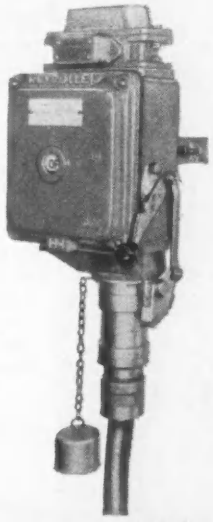

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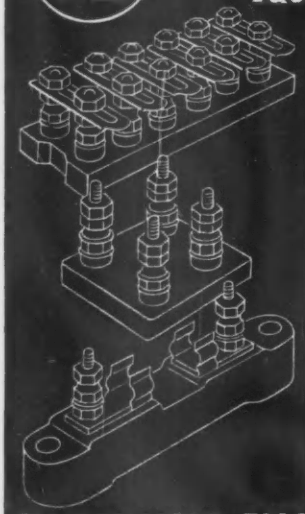

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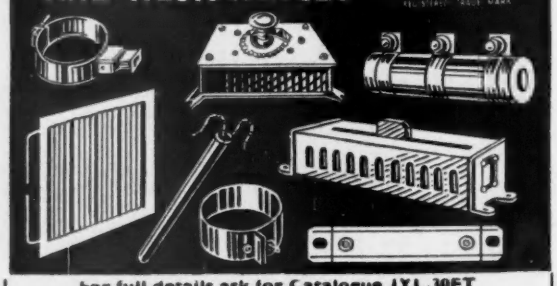

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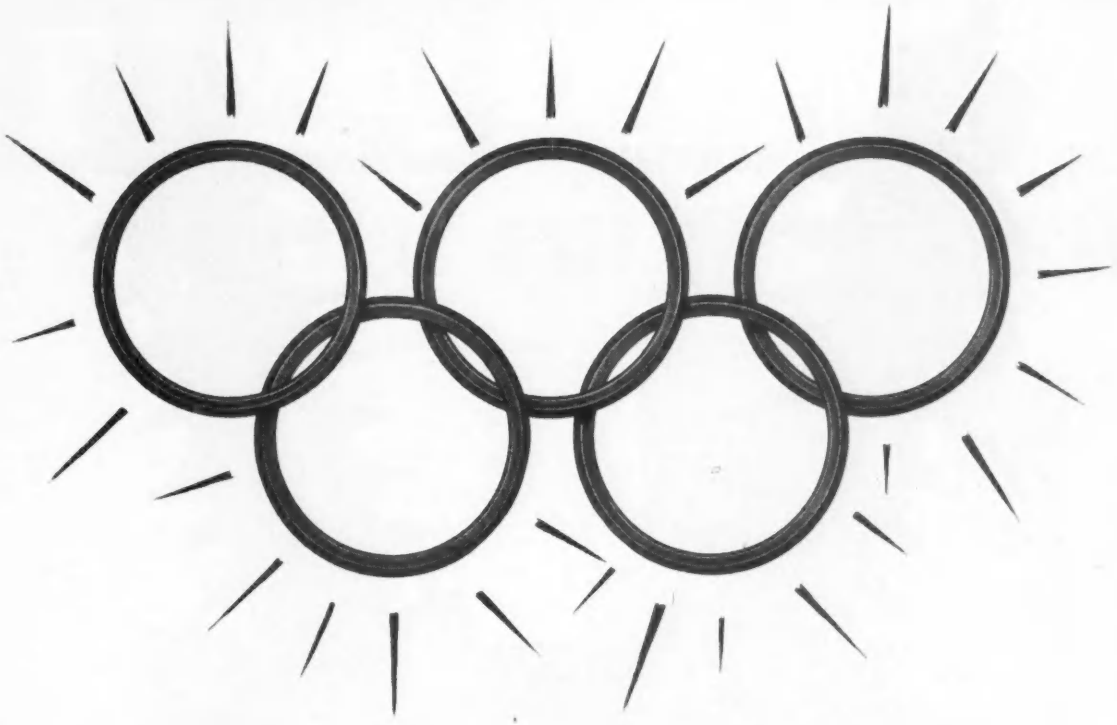

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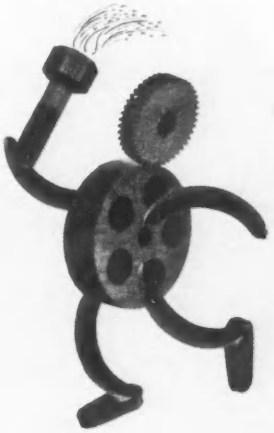

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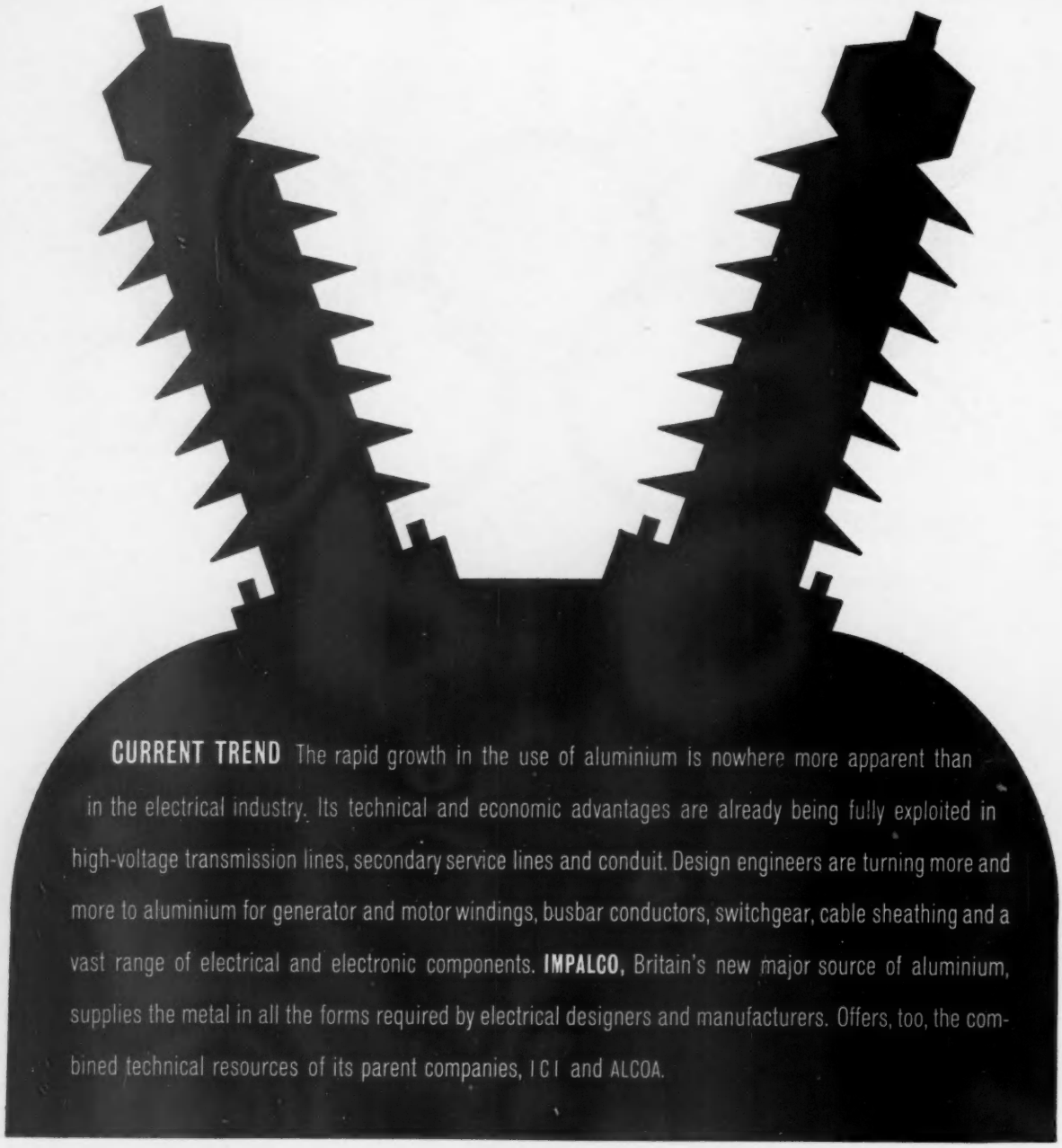

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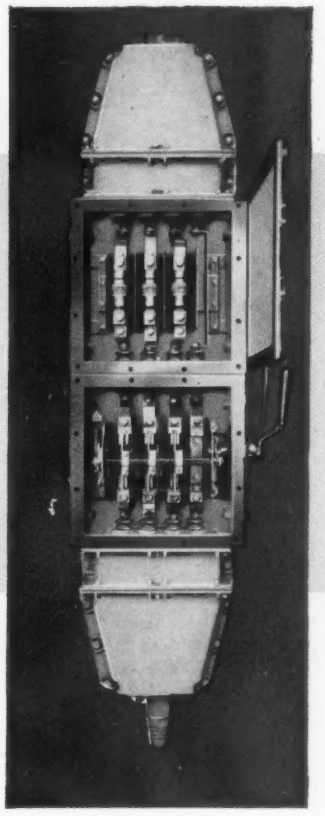

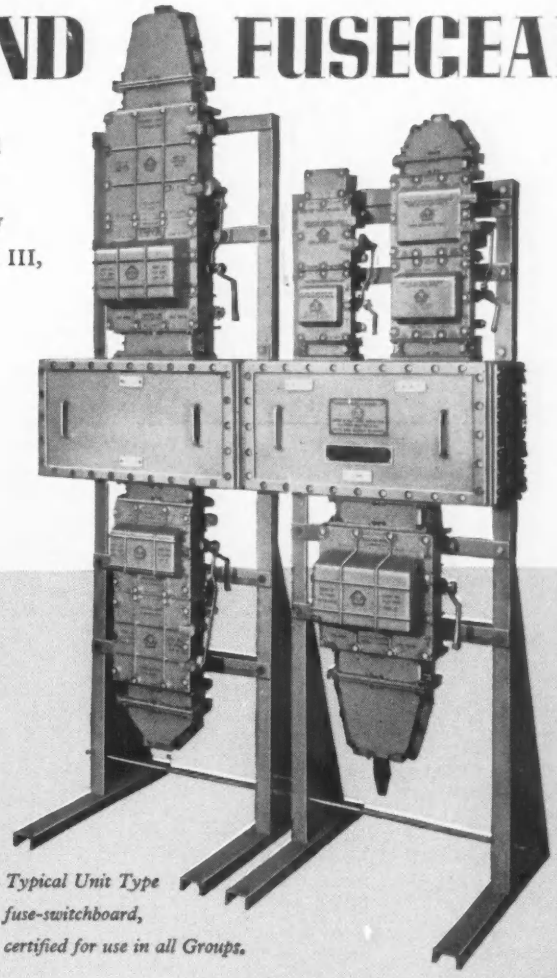

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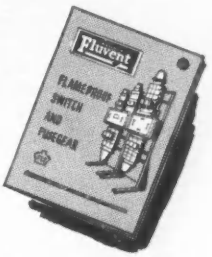

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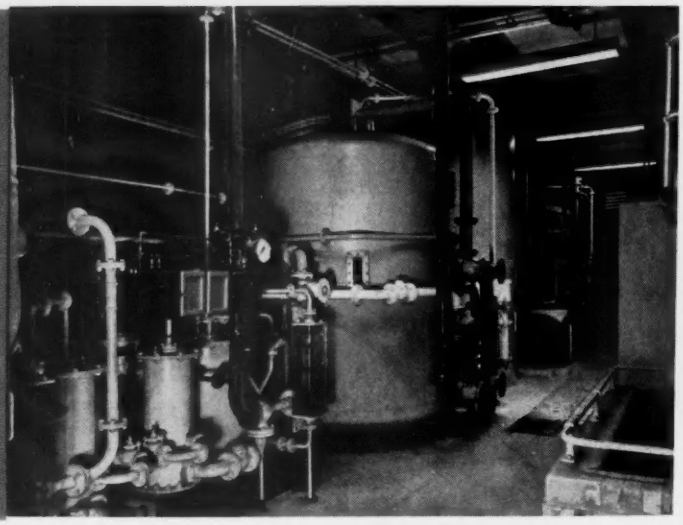
Kennicott De-ionisation Plants are also being installed at Port Agusta Power Station — Australia. Kelvin "B" — South Africa.

** The illustration shows de-ionisation plant at North Wilford Power Station producing 75,000 gallons of treated water in 14 hours for high pressure water tube boilers.*



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